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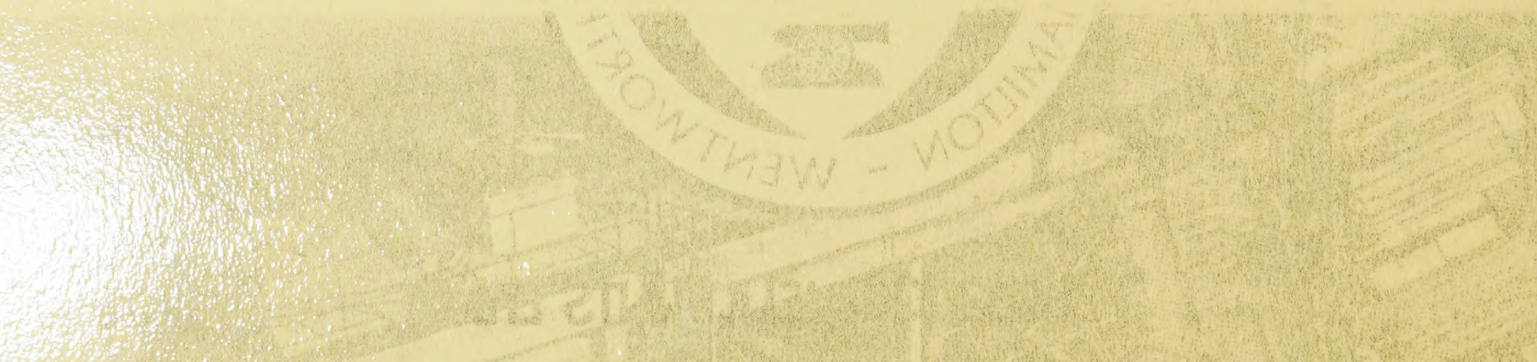
tional design report

reconstruction · burlington street

woodward ave. to kenilworth ave.

THE REGIONAL MUNICIPALITY OF HAMILTON - WENTWORTH

FENCO CONSULTANTS LTD.



Planning
Engineering
Project Management

FENCO

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June 5, 1978

Mr. W.A. Wheten, P.Eng.
Commissioner of Engineering
The Regional Municipality of
Hamilton-Wentworth
71 Main Street West
HAMILTON, Ontario
L8N 3T4

Attention Mr. H. Schweinbenz

Dear Sir:

RECONSTRUCTION OF BURLINGTON STREET
WOODWARD AVENUE TO KENILWORTH AVENUE
CITY OF HAMILTON

We are pleased to submit herein our Feasibility and Preliminary Engineering Study for the reconstruction of Burlington Street at its easterly entrance to the City of Hamilton.

The section of Burlington Street between Woodward Avenue and Kenilworth Avenue is presently severely congested during rush hour periods, and is in urgent need of improvements.

The results of this study indicate that the most effective method of reconstructing the Burlington Street facility would be to construct a continuous overhead bridge structure from east of Parkdale Avenue to west of Strathearne Avenue to carry 4 through lanes of traffic, with a 4-lane-2 way service road underneath the structure.

The estimated total cost of such a facility would be approximately $18,750,000, and could be completed by 1983 if design and property acquisition were to start in 1978.

We have appreciated this opportunity to assist the Region in studying this urgently needed project and trust this report will provide the information necessary for the appropriate decisions to be made leading to on-going design work and eventual implementation.

Yours very truly,
FENCO CONSULTANTS LTD.

E.J. Bartley, P.Eng.
MANAGER

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woodward ave. to kenilworth ave.

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BURLINGTON STREET RECONSTRUCTION

KEY PLAN 1

1.0 introduction and background

2.0 summary and recommendations

burlington street reconstruction

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1.0 INTRODUCTION & BACKGROUND

Burlington Street was assumed by the Regional Municipality of Hamilton-Wentworth on May 29, 1977 from the City of Hamilton. Serving as the single major arterial access to the Industrial Bayfront area from the east, it connects to the Q.E.W., and to Woodward Avenue by grade separated interchanges. Traffic from the Q.E.W. both originating from the east, and from the north via the Skyway Corridor is fed by Burlington Street into the industrial area, and to the collector street network connecting to the downtown areas.

As one of the few major access points to Hamilton, Burlington Street has traditionally carried substantial volumes of traffic. Previously known as Beach Road, the street was widened in 1958 between the Q.E.W. and Kenilworth, to 4 lanes. A further improvement was undertaken in the period 1968-1972, when a grade separated facility, featuring 4 through lanes on elevated structure, with service road facilities underneath was constructed between Kenilworth Avenue and Ottawa Street. Concurrently, a one-way couple, with 4 lanes of traffic in each direction was implemented between Ottawa Street and Sherman Avenue. These improvements resulted in a high capacity facility between a point west of Strathearne to Sherman Avenue, with far lesser capacity between Woodward Avenue and points east of Strathearne Avenue. The 4 lane section between Parkdale Avenue and Strathearne Avenue now carries in the vicinity of 40,000 vehicles per day, its capacity has been exceeded – particularly during peak hours, with resulting extreme congested operating levels.

The City of Hamilton had rated the reconstruction of Burlington Street as a high priority. The Region, upon assumption of the facility, recognized the need for improved capacity and immediately commissioned this study to investigate Burlington Street from Woodward Avenue to west of Strathearne Avenue.

FENCO CONSULTANTS LTD. were appointed to undertake the study in August of 1977.

The purpose of the investigation is two-fold:

i) to determine the feasibility of providing increased traffic capacity by various alternative means, and

ii) having developed viable concepts, recommend the most appropriate scheme and develop a preliminary engineering plan to implement it.

A Technical Advisory Committee, under the chairmanship of the Region and comprised of members from the Region, The City of Hamilton and the Ministry of Transportation and Communications was established to administer the study. Meetings have been held at key intervals to assure recommendations are in keeping with Regional, City and Ministry needs.

2.0 SUMMARY AND RECOMMENDATIONS

The problems associated with improving Burlington Street between Woodward Avenue and West of Strathearne Avenue include:

- an existing right-of-way with continuous industrial development between Parkdale Avenue and Kenilworth Avenue, only limited widening is possible without substantial property damage.
- existing traffic patterns, accesses and entrances that are to be maintained or improved.
- high traffic volumes, with a large percentage of heavy trucks to be accommodated during construction.
- a large number of utilities presently installed in the Burlington Street right-of-way and immediately adjacent to be accommodated during reconstruction and within any widening scheme.
- traffic projections indicating volumes in the 80,000 to 90,000 vehicles per day range by the year 2000.

Several levels of reconstruction were reviewed, each offering a higher capacity. Alternative concepts were developed for each level of reconstruction.

The levels of reconstruction investigated were:

(a) widening of the existing roadway to 6 lanes (maximum possible within R.O.W.) with at grade intersections. Two alternative concepts were developed costing approximately $400,000 to 1,300,000. These concepts proved ineffective in that they would not substantially improve the traffic operations, and have a useful capacity life of less than 3 years if constructed by 1982.

(b) provisions of grade separated interchanges at both Parkdale Avenue and Strathearne Avenue, to be each implemented when required by traffic. This scheme had several disadvantages, including:
   - access was limited to right turns only, median openings were not possible;
   - a "roller-coaster" profile made truck operations more difficult;
   - severe impacts on property
   - poorer operational characteristics

(c) provision of a continuous grade separation from east of Parkdale Avenue to west of Strathearne Avenue, with 4 through lanes on the structure and a 4 lane - 2 way service road underneath. At grade intersections are provided with the service roads at Parkdale Avenue and at Strathearne Avenue.

This latter level of reconstruction is recommended. The recommended scheme concept is illustrated on the exhibits and is outlined as follows:

(A) Through Lanes
   - a 4 lane divided roadway on bridge structure from east of Parkdale Avenue to west of Strathearne Avenue.

(B) Service Road
   - a 4 lane - 2 way service road underneath the structure with provisions for left turns from the median to provide access to abutting properties and,
   - at grade, signalized, intersections with both Parkdale Avenue and Strathearne Avenue.

The structure type would feature rigid frame piers spanning the right-of-way, with steel superstructure spanning between piers, similar to the Kenilworth Avenue structure.

The schedule for construction is such that, for the project to be completed and in operation by mid 1983, design, property, acquisition and utility relocation should be initiated in 1978.

The estimated cost of the facility is $18,750,000 including property, construction, engineering and contingencies. The estimated annual gross cost to completion varies with a low of $200,000 in 1978 and a high of 6,500,000 in 1982.

The reconstruction of Burlington Street must be co-ordinated with planned improvements to the Q.E.W./Woodward Avenue interchange complex, presently under study by the M.T.C. That study is currently reviewing interim improvements to the Beach Strip/ Skyway Corridor to provide added capacity, with provisions for an ultimate major new facility.

3.0 summary of design data
4.0 development proposals
5.0 traffic
6.0 controls and criteria

burlington street reconstruction

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3.0 SUMMARY OF DESIGN DATA

3.1 EXISTING ROADWAY NETWORKS

Burlington Street is at present an east-west arterial terminating at it's interchange with the Queen Elizabeth Way on the east and at Hamilton Harbour on the west. As a major east-west traffic artery Burlington Street provides eastern entrance to the Bayfront Industrial Area, and through north-south arterial roads Woodward Avenue, Parkdale Avenue, Kenilworth Avenue to the core of the City.

Existing Burlington Street within the limits of the project is generally a 4 lane divided arterial with a median of varying width, 6 - 33 ft. Horizontal alignment with the exception of a flat curve between Woodward and Parkdale Avenue is tangential. The existing grade is rather flat, the road raising from east to west. There is a grade separated intersection with Woodward Avenue and signalized, with auxiliary lanes, intersections with Parkdale and Strathearne Avenue.

From Strathearne Avenue westerly Burlington Street is widened to a 6-lane divided facility with two way service roads on both sides, and with structure for through traffic across Kenilworth Avenue.

Burlington Street is a fully illuminated facility, equipped with a complete storm sewer system connected to a combined sewer located in the north part of the road.

There is public transit system (bus service) provided in the area. A pedestrian overpass located between Woodward Avenue and Parkdale Avenue, was originally intended to serve Confederation Park but now is lightly used. This pedestrian overpass will be removed to accommodate future widening.

3.2 LAND USE, ADJACENT PROPERTIES, ETC.

Within the limits of the project the area on both sides of Burlington Street is mainly industrial.

There are two major utility installations located in the area:

a) the Region's Sewage pump station at the north-west corner of Parkdale Avenue and Burlington Street.

b) the Ontario Hydro substation, located at the south-east corner of intersection with Strathearne Avenue, being the main supply point for the industrial area.

The location of industrial and commercial establishments is shown on the plans.

Accompanying photographs further illustrate existing Burlington Street, with it's adjacent development.

3.3 PAVEMENT STRUCTURE AND RATING

Contract 'A', Queen Elizabeth Way connections (1958) show the existing pavement of Burlington Street to consist of 5¼" asphalt (1¼" HL-1, 4" HL-6) on the 9" granular 'A' and 15" granular 'B'. The pavement has failed in many areas and significant base failure has also occurred. The roadway is in need of total reconstruction to an industrial standard.

3.4 ENTRANCES, MEDIAN OPENINGS

Between Woodward Avenue and Parkdale Avenue, Burlington Street is a controlled access arterial with Windermere Road to the north serving as a frontage road with access to it from Parkdale Avenue. Leaside Road parallels Burlington Street to the south providing access to residences south of Burlington Street.

East of Strathearn, looking easterly

Looking towards Parkdale - Pioneer Service Station on right - Procter & Gamble Warehouse on left

Looking easterly to Parkdale *Median opening for Procter & Gamble*

Rush hour traffic approaching Parkdale Avenue

Parkdale intersection, at Fina Station

East of Parkdale, looking to pedestrian overpass

Pedestrian overpass near east limits of project

Existing Kenilworth structure typical detail

From Parkdale to Strathearne Avenue, Burlington Street is developed with semi-controlled commercial entrances, in that some of these entrances are limited to right turn in and right turn out only. There are two median openings to accommodate major entrances.

West of Strathearne Avenue access to industrial properties is provided from the north and south service roads.

3.5 SOILS CONDITIONS

There are several soil reports prepared for the area, including:

- May 1958 - prepared by Construction Borings Limited for City of Hamilton sewers, and sewage treatment plant;
- May 1963 - prepared by E.M. Peto Associates Ltd. for Proctor and Redfern;
- Dec. 1957 - prepared by Construction Borings Limited for C.C. Parker and Associates Limited.

Soils generally consist of 35 to 40 feet of stiff clay overlaying red shale, and are considered competent for roadway and structure construction purposes.

The elevation of the water table varies from 2-15 feet below the existing ground surface.

3.6 UTILITIES

Utility installation along Burlington Street consists of:

i) Regional Municipality of Hamilton/Wentworth
   - sewers and watermains in the right-of-way;
   - pumping station at the NW corner of Parkdale.

ii) Hamilton Hydro
   - underground distribution system, and overhead lighting

iii) Bell Telephone
   - underground duct system

iv) United Gas
   - gasmain in median and along R.O.W. edge

v) Trans-Northern and Petrofina Canada
   - pipelines located near north right-of-way edge

vi) Ontario Hydro
   - major transformer station at the SE corner of Strathearne Avenue and Burlington Street, with high voltage tower lines south of, and straddling Burlington Street.

Details of the location of these installations are shown on accompanying plans and, on the typical sections. Large scale utility plans will be provided to the Regional Engineering Department for their information.

4.0 DEVELOPMENT PROPOSALS

4.1 REGIONAL OFFICIAL PLAN

During the preparation of this report in the period from September 1977 to the present, the Regional Official Plan, as it relates to proposed development patterns, was in the process of being finalized. Although at the time of this writing, the Official Plan is not completed and adopted, all the development patterns reviewed by the Region called for extensive improvements to Burlington Street. The level of improvement required varied with each development pattern depending on the location, type and rates of growth for the differing locations of population and employment. Traffic projections for this study were reviewed on the basis of the recommended development plan, which indicates significant new developments to the eastern and southern limits of presently developed areas.

4.2 TRANSPORTATION IMPROVEMENT PRIORITIES

The Regional Municipality of Hamilton-Wentworth assumed the Burlington Street facility, effective May 29, 1977. The City of Hamilton had indicated improvements to Burlington Street as having a very high priority at the time of this take over, due primarily to congested operating conditions with attendant traffic delays and a deteriorating driving surface requiring consideration for major maintenance.

The Region, in agreement, placed a similarly high priority on improvement to this facility, and immediately commissioned this study, to review means of increasing capacity. Given the normal time periods required for property acquisition, design, utility relocation and construction, a new facility could not be ready for use until late 1982 or early 1983 if design were to start immediately.

Associated with the Burlington Street reconstruction is the required improvements the Skyway corridor, now under study. The results of this study are as yet not known but it is considered that interim improvements to this facility could be ready for use concurrently with Burlington Street.

5.0 TRAFFIC

5.1 EXISTING TRAFFIC

Burlington Street is a major east-west arterial facility serving the industrial development along the southern shore of Lake Ontario in the City of Hamilton and provides access to and from the QEW for the bulk of the trips generated or destined within the City of Hamilton. The traffic volumes within the limits of this project are 42,000 vehicles per day on Burlington Street with volumes of 11,500 & 8,000 vpd on Parkdale and Strathearne Avenues respectively.

The existing traffic data for this study was assembled from traffic counts conducted by the City of Hamilton (fig. 1), industry interviews and site visits. Based on all the available traffic data existing traffic volumes (fig. 2) were generated in order to provide a basis for the forecasting of future traffic volumes within this area.

The nature of the industry in the project vicinity generates a high percentage of truck (10-15% during peak hours) with heavy wheel loads and occassionally high clearance requirements (20 ft.). The low acceleration of these vehicles severely reduces the operation of the intersections as well as the overall capacity of the road network.

With the heavy truck movements, the two major intersections at Parkdale and Strathearne Avenues and the frequency of industrial entrances along Burlington Street, a multitude of conflict points are generated throughout the network resulting in reduced capacity and extensive congestion.

A bus route is provided along Burlington Street, however, a low percentage of the total trips are transit oriented

5.2 FORECASTING PROCEDURES

From data obtained from the Regional Municipality of Hamilton-Wentworth, the City of Hamilton and the interviews with several of the major industries, an analysis of the traffic was carried out to arrive at a satisfactory forecasting technique.

Close liaison was maintained throughout the study with the Regional staff in order to conduct a "micro" traffic study of the project area.

Traffic forecasts were derived using historical data obtained from the City of Hamilton, developing historical growth rates and then extrapolating the Burlington Street volumes (fig. 3 & 4) to generate future demands. These volumes were then compared to those forecast by the Regional Planning Office using the 2001 Conglomerate Land Use. The analysis, based on the Regional forecasts and the historical growth trends, indicates that the growth factor between 2.5 and 3.4 per cent per annum best reflects the potential traffic demand in this area. With the aid of this growth factor, future AM and PM peak hours volumes were generated for 1985 (fig. 5) and 2001 (fig. 6)

Hourly variations (fig. 7) were compiled from data obtained from the City of Hamilton and reveal that the "peak hour" has a 2 to 3 hour duration which results in the DHV percentage of AADT tending to be below the conventional 10%. This fact is the result of; the diversified trip purposes, such as, commercial versus industrial trips, clerical versus production employee trips and the implementation of staggered shift work by the major employers.

Further analysis of this data (fig. 7) indicates that the Design Hourly Volumes percentage of the AADT volumes is in the order of 8 to 8.5%.

Due to the nature of this area the daily and seasonal variations in the traffic are relatively small and do not have any significant effect on the capacity of the proposed roadway system.

5.3 FUTURE TRAFFIC VOLUMES

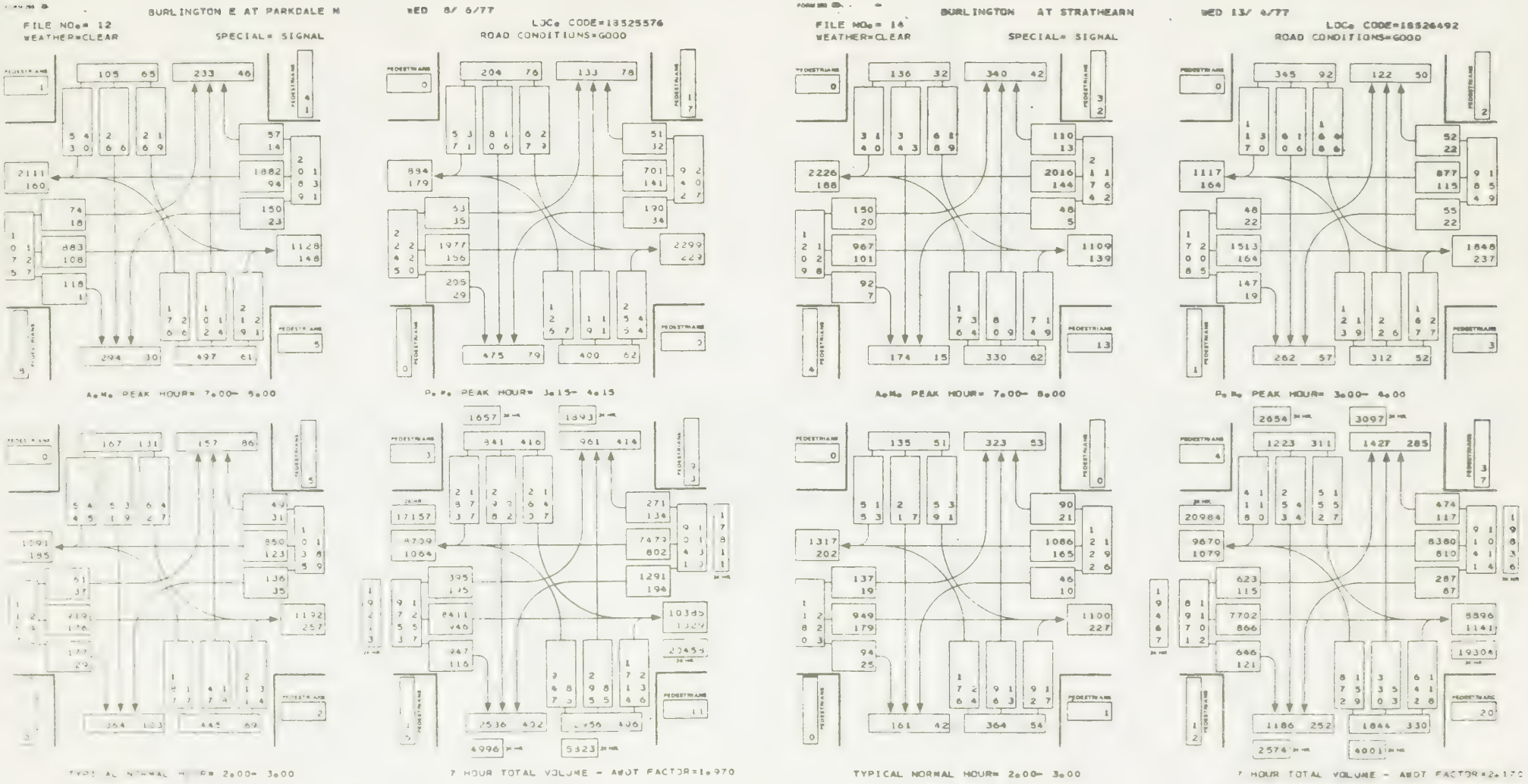
Several schemes were analysed (see section 2.0) with the results tabulated on figure 8. This figure indicates the following:

a) The existing roadway is presently deficient.

b) If Burlington Street were reconstructed to 6 lanes with double left turns from E to S and S to E, at Parkdale Avenue, it could become inadequate by 1985,

c) If an 8-lane facility, with a 4-lane expressway over a 4-lane at-grade collector, were constructed, the facility would be adequate well beyond 2001.

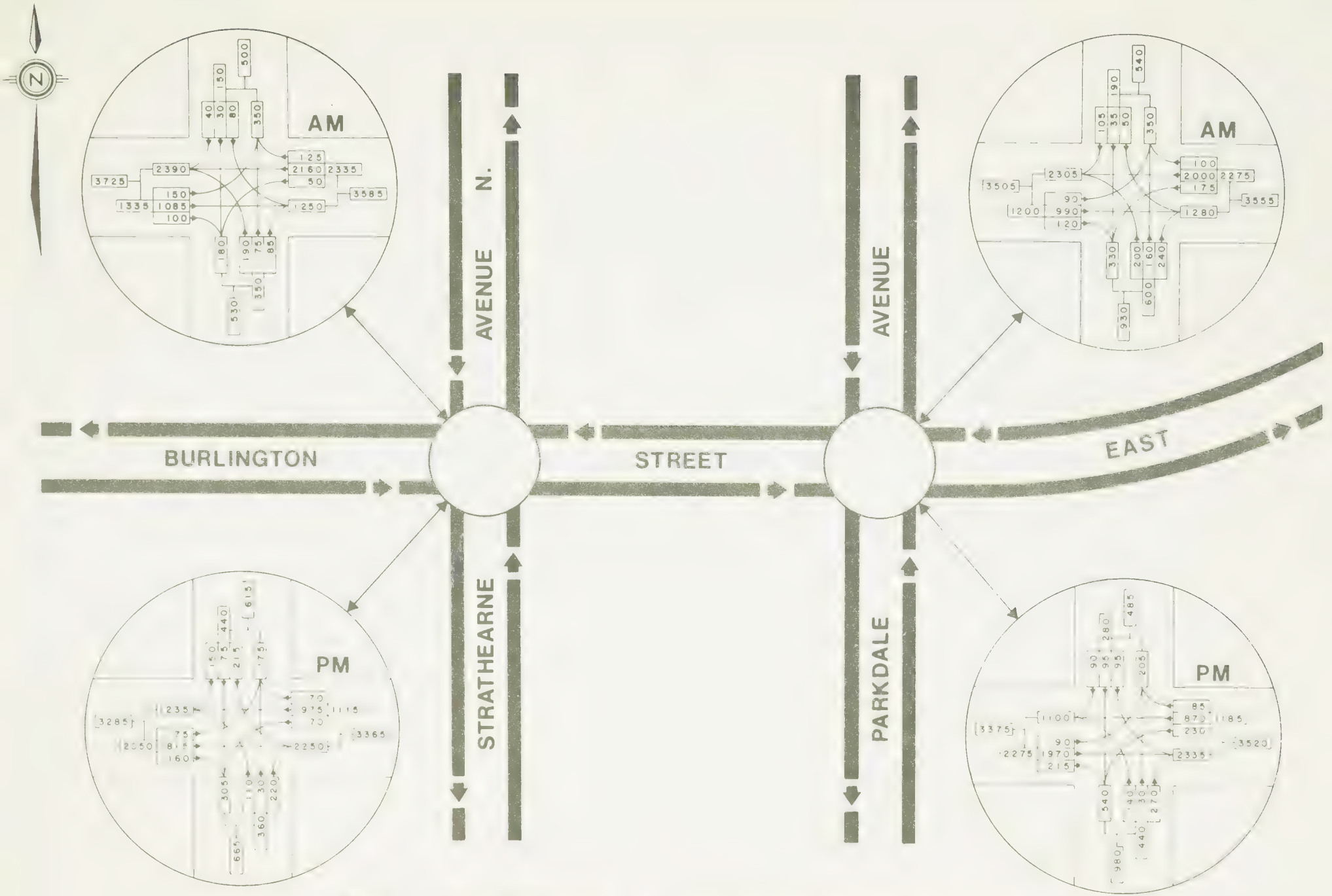
In summary, the reconstruction of the existing 4-lane system, with the addition of a 4-lane free flowing overpass along the Burlington corridor and the construction of a point-diamond intersection at both Parkdale and Strathearne will provide an adequate facility to serve the 2001 demands.



• LOWER/RIGHT HAND FIGURES INDICATE TRUCK VOLUMES

CITY OF HAMILTON
TURNING MOVEMENTS-1977
EXISTING COUNTS

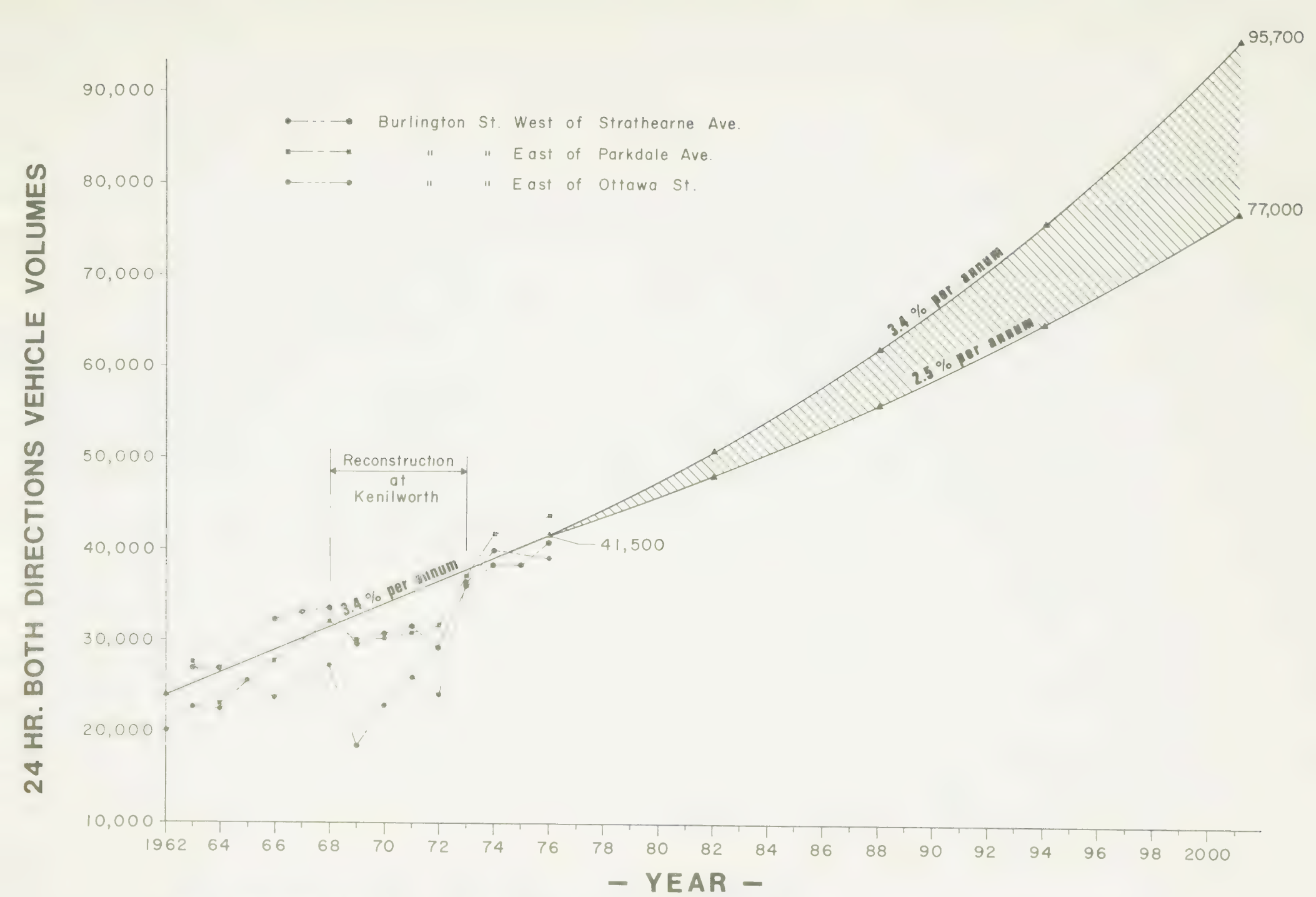
Figure 1



Design Hour Volumes — Equivalent Passenger Cars

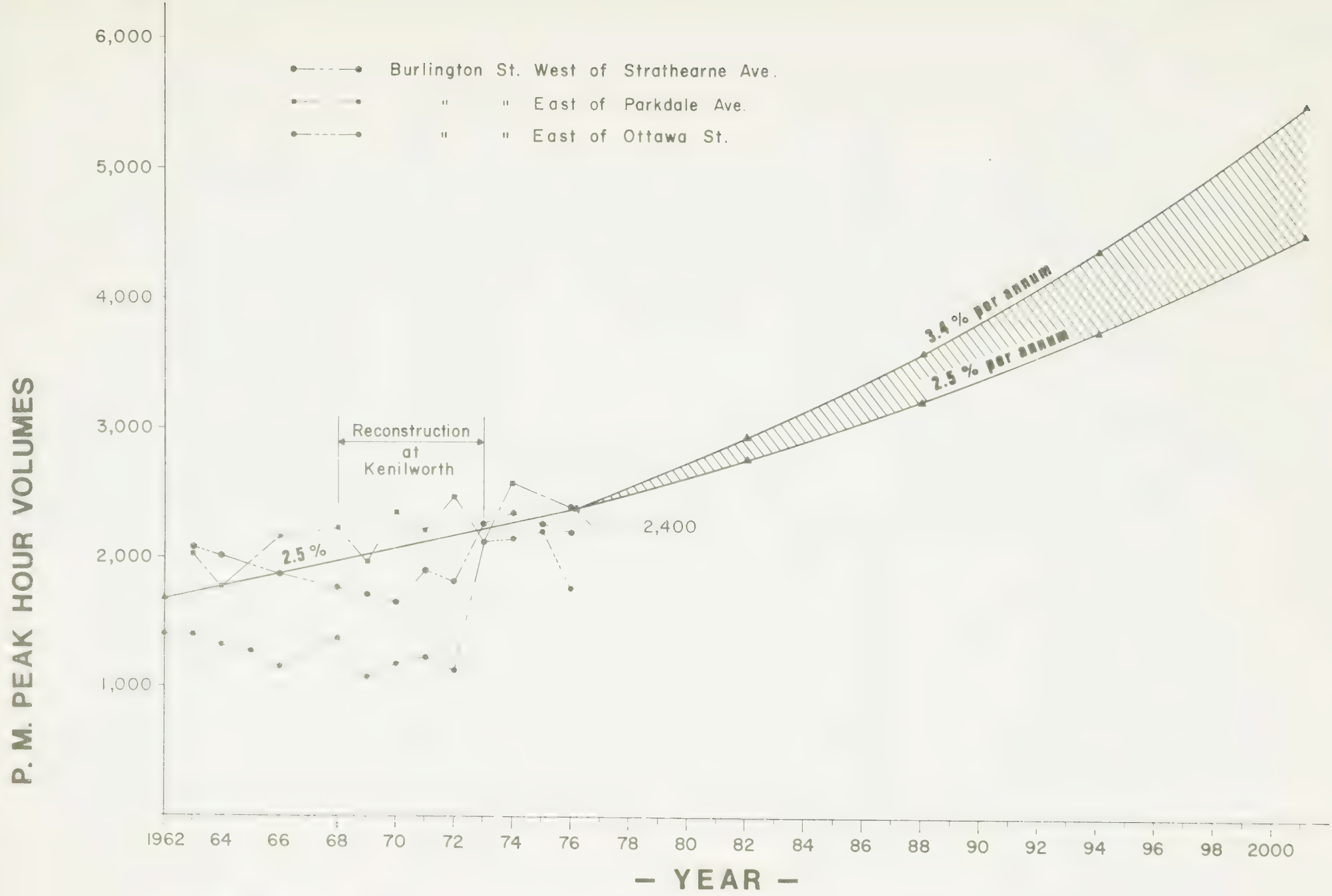
EXISTING TRAFFIC 1977

Figure 2



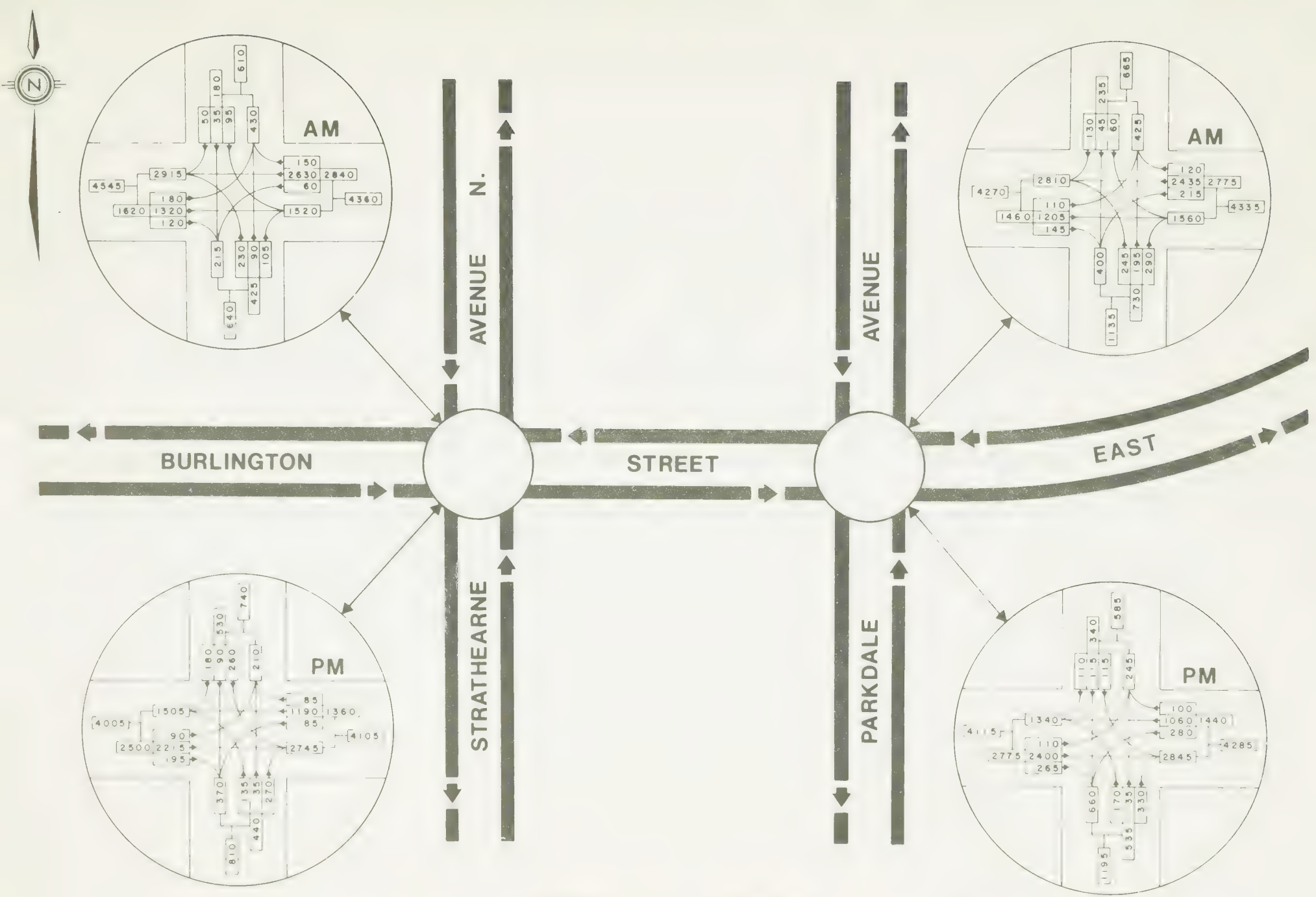
AADT (from 1962 to 1976)

Figure 3



P. M. PEAK HOUR VOLUMES (from 1962 to 1976)

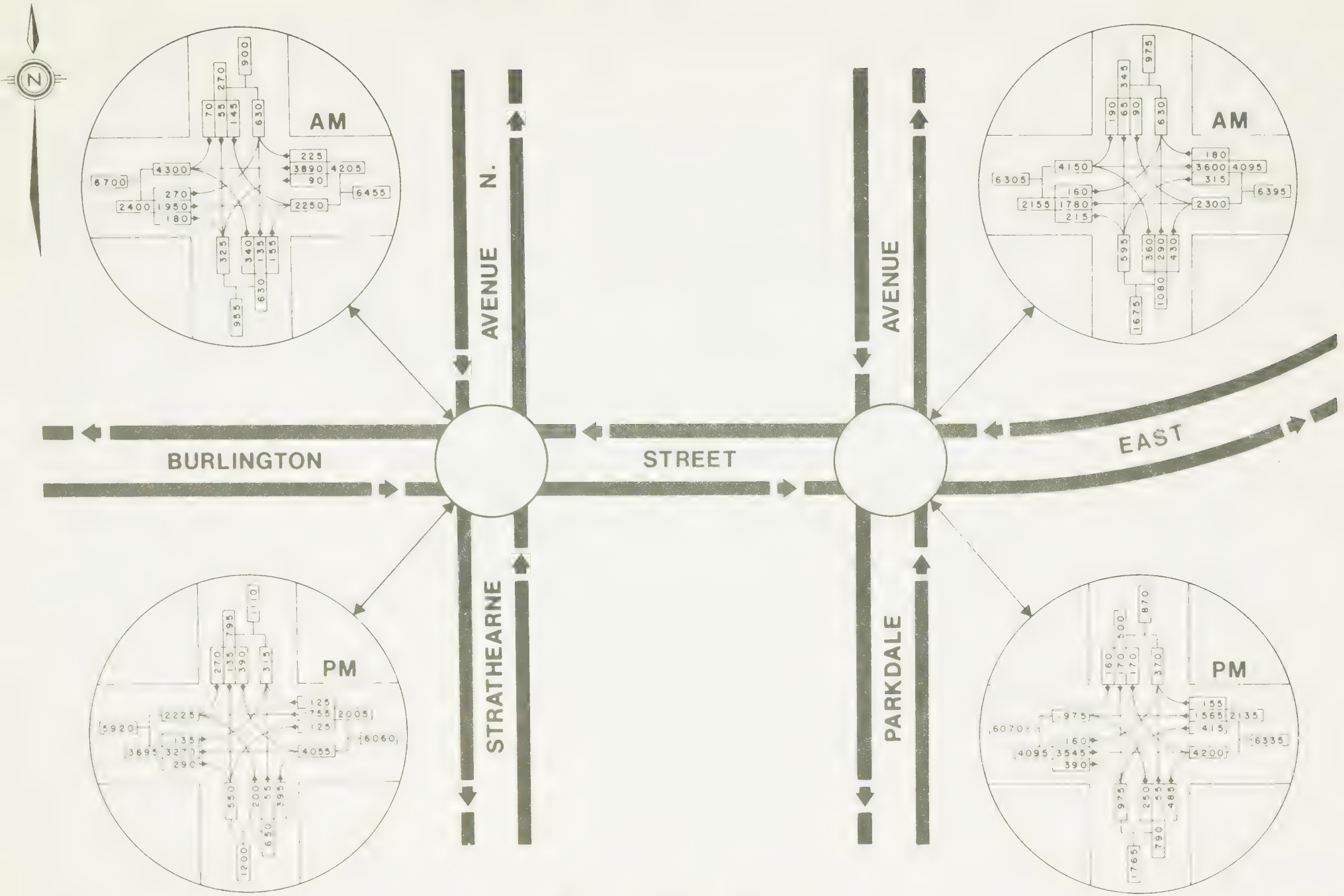
Figure 4



Design Hour Volumes

1985 TRAFFIC FORECAST

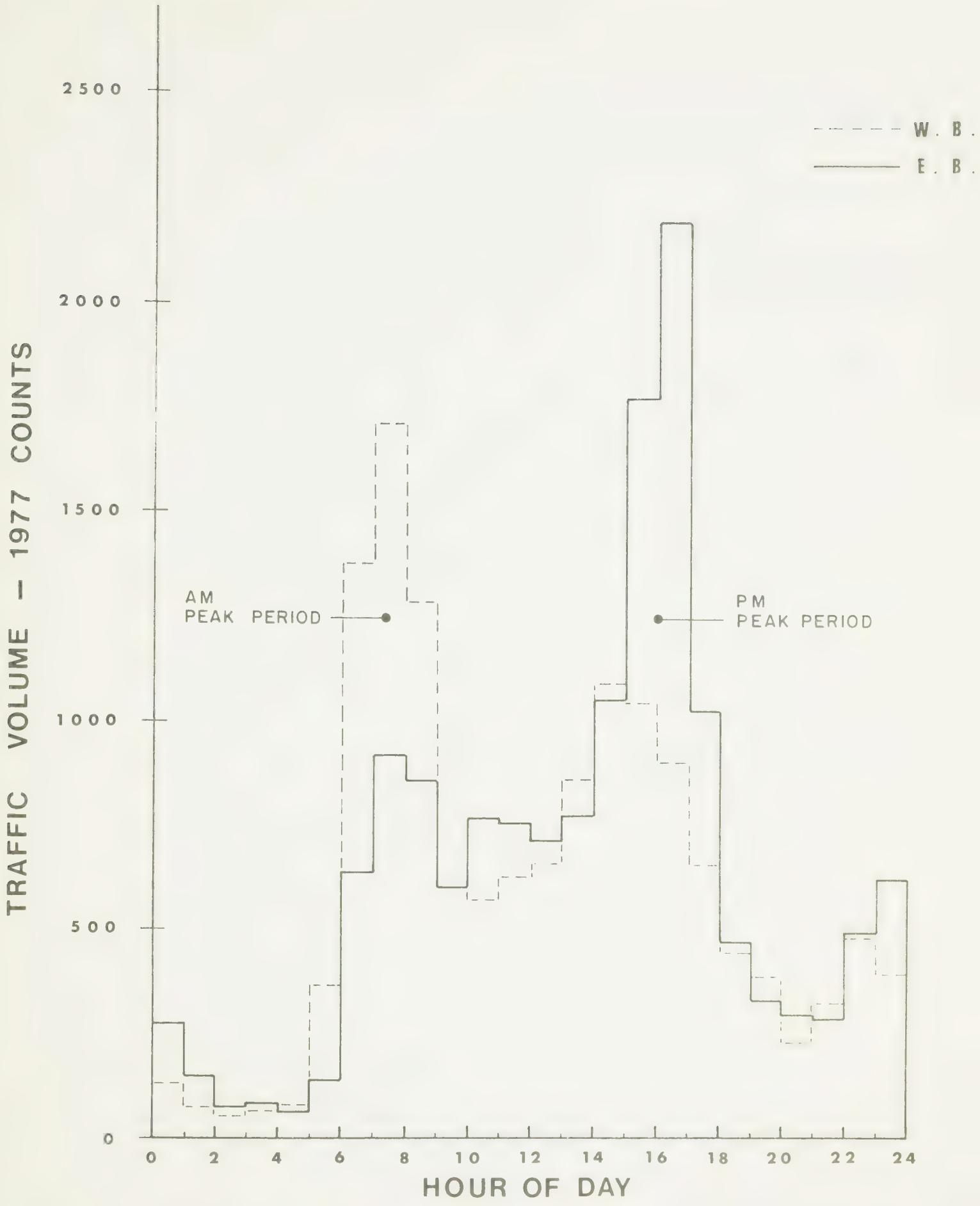
Figure 5



Design Hour Volumes

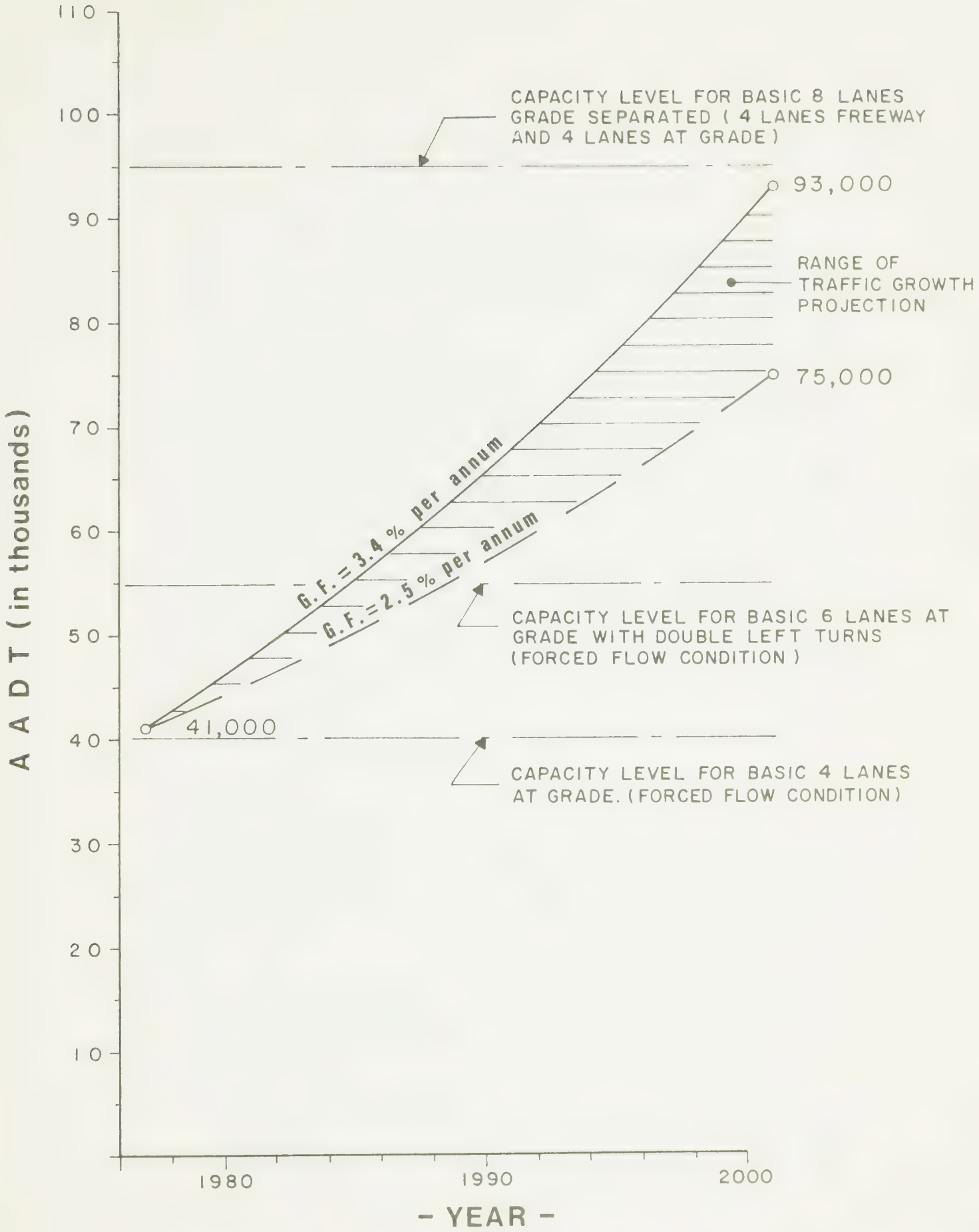
2001 TRAFFIC FORECAST

Figure 6



HOURLY VARIATIONS

Figure 7



GROWTH CHART

Figure 8

6.0 CONTROLS AND CRITERIA

6.1 MAJOR CONTROLS

During the course of the investigation several major physical controls were identified along the Burlington Street corridor that required consideration in the development of reconstruction concepts. These are outlined below, with their specific effect on design noted:

6.1.1 Property and Buildings

The existing property limits for the Burlington Street R.O.W. have been generally accepted as being a control throughout the length of the project, particularly between Parkdale Avenue and Strathearne Avenue. Beyond these points additional property has been required to be able to join to the existing roadway.

Major widening of the existing roadway could not be accomplished without substantial property damages with attendant high cost. This cost is expressed not only in the cost of acquisition but also in the cost of displaced industries.

The north property limit has buildings with wall lines directly on the property edge, hence in all schemes the north right-of-way edge has been established as a control, with no widening to the north permitted. Widening to the south requires either the taking of property or reconstruction of buildings to suit new property lines.

The major property requirements are shown on the plans (Exhibits 3, 4, 5). The effect of specific properties on various schemes is indicated in Section 7.0. Results of meetings with property owners will be provided to the Region in separate documents.

6.1.2 Utilities

The major utility installations along the Burlington Corridor are outlined under the Existing Condition, section 3.0.

The effect of various schemes on utility relocation requirements is outlined in Section 7.0.

6.1.3 Profile Considerations

All existing entrances and traffic movements must be maintained. Major regrading of entrances cannot be accomplished, hence, the profile of the existing road must be maintained for the Service Roads. Drainage considerations and the location of existing utilities further dictate minimum change to the existing grade.

6.2 TRAFFIC REQUIREMENTS

Section 5.0 describes existing and future traffic conditions. In summary reconstruction alternatives must satisfy the following traffic considerations:

6.2.1 Volumes

The service road system under the through lanes on the structure, and at the grade intersections at Parkdale and Strathearne Avenue must be designed to handle the year 2000 volumes indicated on the turning volume diagrams. These volumes dictate a 4 lane facility for the service roads with adequate extra turning lanes at the intersections, and a 4-lane elevated roadway to carry through traffic.

6.2.2 Entrances

Access to all abutting businesses must be provided from the service road system. A continuous median, with median openings will be provided where possible, since U-turn manoeuvres cannot be accommodated at the intersections of Parkdale Avenue and Strathearne Avenue.

6.2.3 Sectional Road Capacities

The type of facility existing west of Strathearne Avenue features 4 lanes on structure with 4 lanes of service road underneath. West of this section, at Ottawa Street, a 4 lane 1-way couples, a total of 8 lanes.

To the east of Parkdale Avenue 6 lanes of free flow traffic are envisaged.

The provision of compatible roadway facilities between these two types for continuity of systems is required.

6.2.4 Construction Staging and Maintenance of Traffic

During construction existing volumes of traffic must be accommodated at all times. Four lanes of traffic must be kept open during peak periods, with only limited periods when the roadways could be limited to 1 lane in each direction. Reconstruction alternatives must provide for these conditions.

6.3 DESIGN CRITERIA

The following design criteria are recommended for the reconstruction of Burlington Street between Woodward Avenue and Kenilwo:th Avenue.

	Through Lanes on Structure	**Service Roads Under Structure**
Roadway classification	Urban expressway/arterial, divided	Urban collector divided
Number of lanes	4	4
Design speed	50 mph	40 mph
Lane width	12 feet	11 to 12 feet
Maximum curvature	Dc = 3°	Dc = 12°
Maximum grade	5%	5%
Minimum stopping sight distance	350 feet	275 feet
Maximum superelevation	6%	6%
Right of way width	132 feet (existing)	132 feet (existing)
Access	no access	Controlled, limited to existing entrances
Intersections	grade separated	at grade - signalized
Illumination	Roadside mounted poles. Lighting level of 1½ foot candles.	Full illumination. Luminaires mounted on structure where possible. Lighting level 1½ foot candles.
Drainage	Deck drains connected to storm sewer system	Storm sewer system
Vertical clearance	5'	min. 15' - 3" allowance for overheight loads on Parkdale Avenue and Strathearne Avenue, 20' - 0" minimum

NOTE: *Sidewalks will be installed along service roads where required.*

7.0 design proposals
8.0 public participation

burlington street reconstruction

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7.0 DESIGN PROPOSALS

7.1 DEVELOPMENT OF SCHEME CONCEPTS

The preliminary appraisal of the project indicated Burlington Street was operating under forced flow conditions during peak hours with the present volumes. Peak hour congestion was significant, particularly at the Parkdale intersection.

Various levels of reconstruction, each offering increasingly higher capacities, were identified and ranked in order of capacity. These included:

(i) widening to 6 lanes in the median of the existing roadway cross section, with simple intersection layouts, featuring single left turn lanes. No property would be required.

(ii) widening to 6 lanes, with more sophisticated intersection layouts featuring double left turn lanes requiring property at the Parkdale intersection to provide for widening to accommodate the double lefts.

(iii) staged improvements wherein provision for a grade separated interchange at Parkdale Avenue only with widening to 6 lanes to Strathearne Avenue. When later warranted a second interchange could be provided at Strathearne Avenue to provide matching capacities.

(iv) continuous grade separated facilities featuring 4 through lanes on structure with 4 lanes of service road beneath, intersecting with both Parkdale and Strathearne Avenue.

The results of capacity calculations, as shown in Section 5.0, indicated that:

Concept (i) would not provide for sufficient intersection capacity to handle present turning volumes, and was rejected.

Concept (ii) providing for double left turns, would break down in the year 1985. By the time this scheme could be implemented, it would not have provided sufficient useful life to be economically worthwhile, and again was rejected.

Concept (iii) and (iv) had several variations, all of which were evaluated in considerable depth, and are outlined in the following Section 7.2. The basic factors, as outlined in Section 6.0, used in evaluating these schemes were:

- cost - initial and ultimate
- levels of service provided for traffic operations
- impact on properties already established on the Burlington Street corridor
- ease of construction for maintenance of traffic and staging
- effect on utilities

7.2 SUMMARY OF MAJOR ALTERNATIVES

7.2.1 Scheme No. 1 — Cost = ±$400,000

Minimum reconstruction — widen to 6 lanes

Two additional lanes between Parkdale and Strathearne in the existing median, and to the outside east of Parkdale. This scheme was eliminated because no capacity would be gained at the intersection with Parkdale Avenue. This scheme would require minimum property on south side of Burlington close to Parkdale and no major utilities problem except for relocating several light poles (length = 1000').

Advantages of this scheme are:

- low cost
- minimum property requirements
- no major problems with utilities

Disadvantages:

- no additional capacity
- median width not sufficient to provide left turn lane for entrances to individual industries
- will be immediately congested
- will be non effective for construction detours of any major reconstruction

7.2.2 Scheme No. 2 — Cost = $1,325,000

Widening to 6 lanes at grade — with double lanes for left turn from Burlington Street to Parkdale Ave. South.

After introducing the double left turn at the Burlington and Parkdale intersection the capacity of this intersection will suffice to 1985. For this scheme The Country Style Donuts property will have to be acquired as well as a significant part of The Fina Gas Station.

The drainage of south side of Burlington St. will have to be adjusted and the lighting system rebuilt for a length of ±1500 ft. along Burlington St. and ±600 along Parkdale Ave.

Advantages of this scheme are — (relative to Scheme No. 1)

— capacity of Parkdale intersection sufficient to 1985

Disadvantages:

— significant property requirements
— part of new roadway will be wasted in the next stage
— capacity exceeded in 1985.

Because the capacity of the Parkdale intersection will be sufficient only to 1985 this scheme can be considered only as interim stage for future upgrading.

7.2.3 Scheme No. 2a — Cost = ±1,750,000

6 lanes, intersections at grade, double left turn from Burlington St. to Parkdale South.

To make Scheme 2 compatible with Scheme 6, the intersection with Parkdale was widened to allow for building a future structure, without detours. The costs include raising of two hydro towers to provide clearance for structures and relocation of the combined sewer between Parkdale and Strathearne.

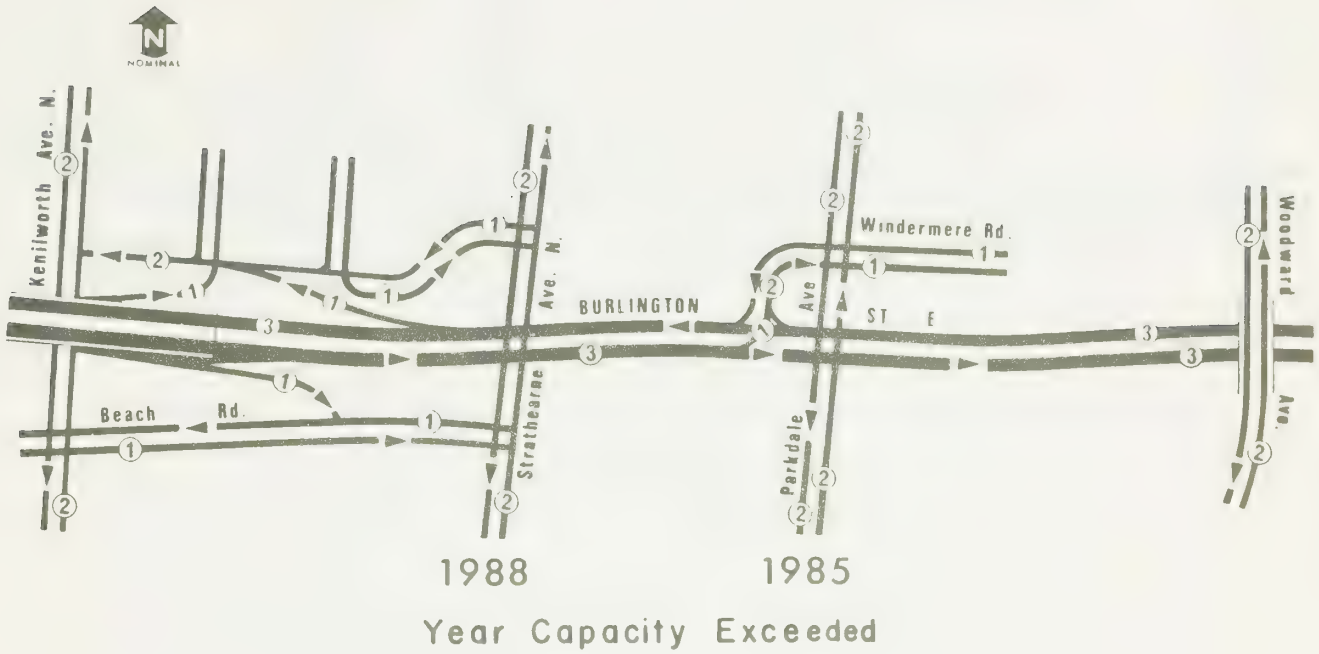
Advantages — comparing to Scheme No. 2

— easier future improvements

Disadvantages — higher initial cost

— capacity limited to 1985

7.2.4 **Scheme No. 3 — Cost = $1,900,000**
At grade, Loop at Parkdale around pump station.



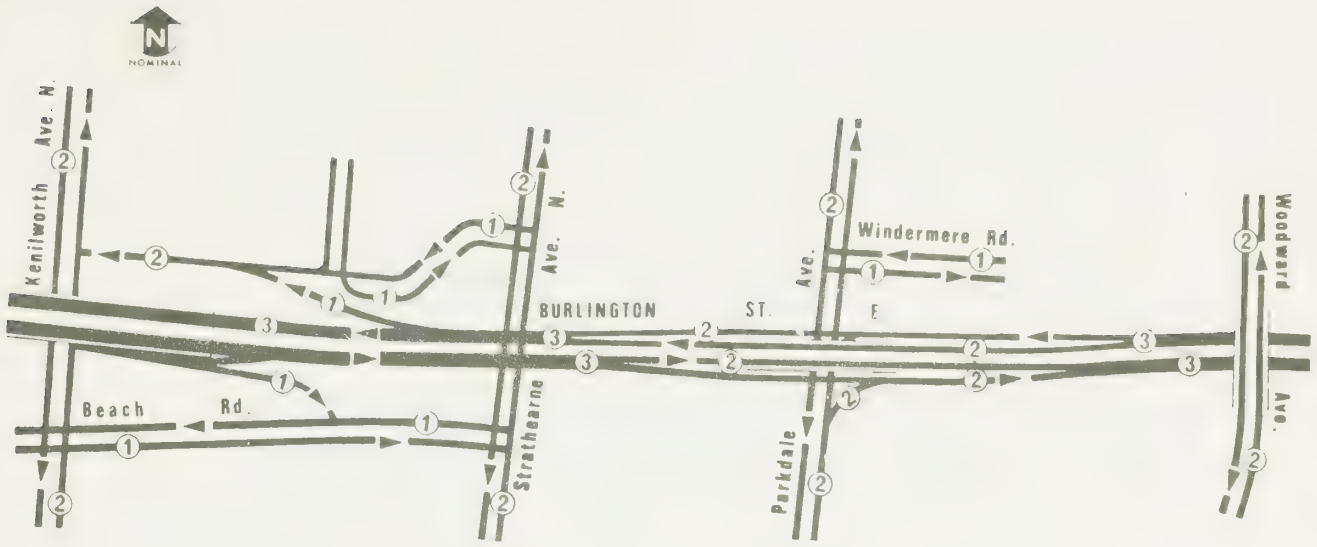
This scheme provides improvement to the capacity of the Parkdale intersection and might be considered the initial stage for future schemes No. 9 and No. 10. Significant improvement to the Parkdale — Windermere intersection are offered. Major impact on the Kent Steel Products property (parking, entrance, future expansion area) would cause relocation of business. This scheme was eliminated.

Advantages — comparing to Scheme No. 2
- higher capacity
- significant improvements of Parkdale Windermere intersection

Disadvantages:
- major property requirements in north west corner - Kent Steel
- entrance to side road to Parkdale N from the loop

7.2.5 **Scheme No. 4 — Cost = ±$8,700,000**
Grade separation at Parkdale — Burlington over single structure.

This scheme provides very high capacity at Parkdale interchange and can be considered as the initial stage to Scheme No. 5. Because of insufficient clearance west of Parkdale the south service road will be located well to the south with a major impact on three industrial properties on the south side of Burlington. In addition to removing The Fina Gas Station the three industrial buildings would have to be rebuilt and the access road to the industrial properties along the railroad would have to be provided.



1988 2001 +

Year Capacity Exceeded

Advantages:

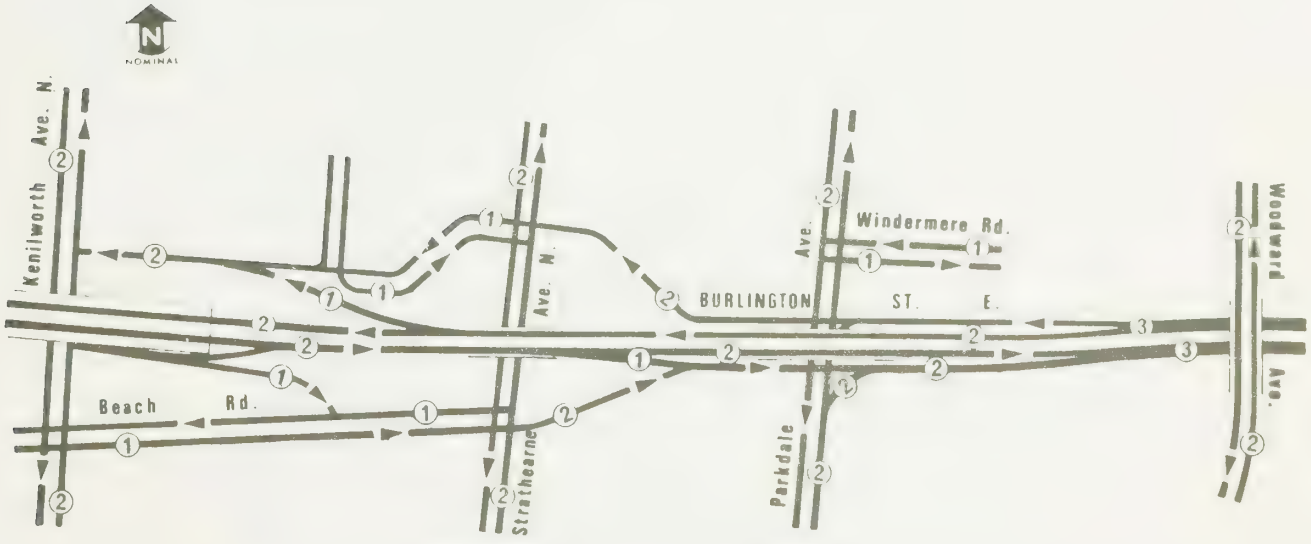
- high capacity of Parkdale intersection

Disadvantages:

- short weave section between Woodward and Parkdale
- high cost of property
- entrances along Burlington St. limited to right turn in and right turn out only

7.2.6 Scheme No. 5 — Cost = ±$18,800,000

Grade separation at Parkdale and Strathearne, double structure.



2001 + 2001 +

Year Capacity Exceeded

Transfer lane for eastbound traffic is provided from structure to the service road. In the Parkdale Avenue vicinity this scheme is identical to Scheme No. 4.

This scheme will have a major impact on properties on the south side of Burlington St. (approx. cost +3,700,000).

Advantages:

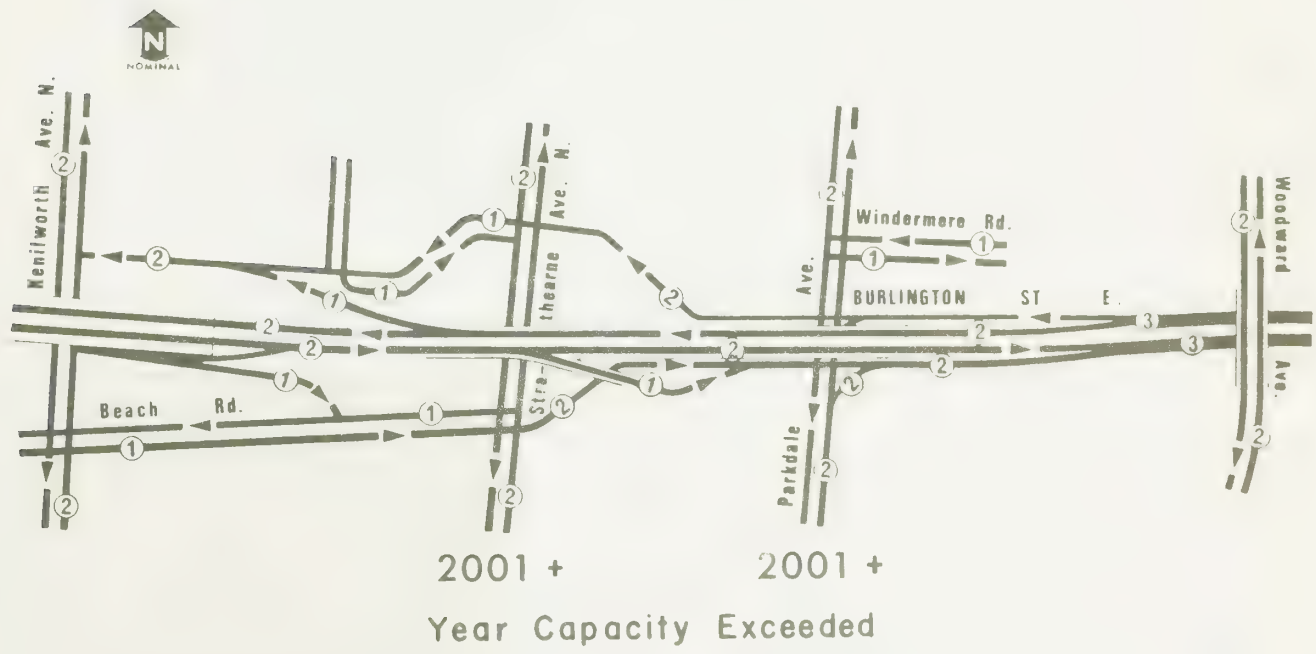
- high capacity of both intersections
- staging possibilities (scheme No. 4 as first stage)
- flexibility of traffic movements. Traffic eastbound to Parkdale can be on structure over Strathearne.

Disadvantages:

- short weave section between Woodward and Parkdale
- major impact on properties on south side of Burlington Street
- entrances along Burlington Street limited to right turn in and out only.

7.2.7 Scheme No. 6 — Cost = ±$20,100,000

Continuous rigid frame structure with 'A' type ramps.



Transfer lane for eastbound traffic from structure to service road. This scheme has much less impact than Scheme No. 5 on properties along Burlington Street, but may require removal of two hydro towers east of Strathearne and would eliminate the entrance to The Pioneer Service Station on the South side of Burlington. To solve this problem, scheme No. 11 was developed.

Advantages:

- easy access to industrial buildings along Burlington
- high capacity of both intersections
- flexibility of traffic movements. Eastbound traffic to Parkdale can be on the structure over Strathearne Avenue.

Disadvantages:

- high cost
- short weave section between Woodward and Parkdale
- impact on Pioneer Service Station

7.2.8 Scheme No. 7 — Cost - not estimated

Continuous structure, Hammer-Head Piers and central columns.

This scheme was rejected in favour of Scheme No. 6 because of extensive conflict of the structure with existing utilities in the median.

7.2.9 Scheme No. 8 — Cost - not estimated

Grade separation at Parkdale with Parkdale over Burlington.

This scheme was rejected for two reasons:

a) railway crossing Parkdale south of Burlington must remain, hence a much longer structure is required, property damages are extensive.

b) necessity of rebuilding existing pump station in the north west corner approx. cost ± $750,000.

7.2.10 Scheme No. 9 — Cost = ±11,400,000

Grade separation with loop type ramps at Parkdale and Strathearne.

Year Capacity Exceeded

This scheme was considered as next stage to Scheme No. 3. In addition to very high capacity of the Parkdale and Strathearne intersection this scheme provides significant improvement to the Windermere/Parkdale intersection. This scheme was eliminated because of the major impact on adjacent properties.

Advantages:

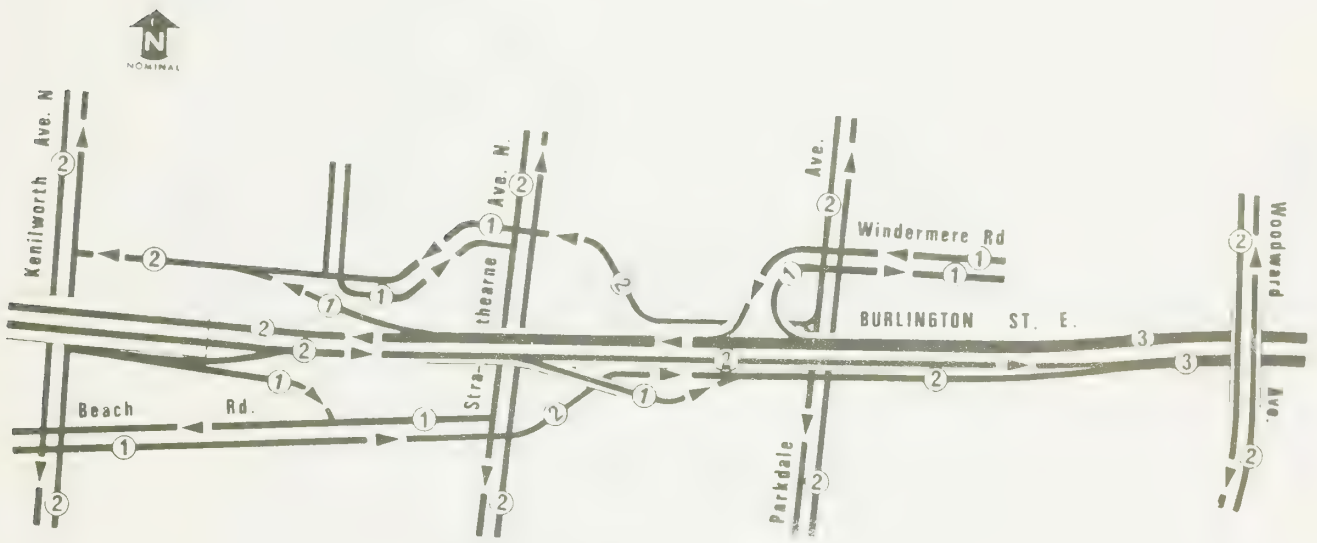
- longer weave section between Woodward and Parkdale
- high capacity
- significant improvement of Parkdale and Windermere intersection
- easy staging

Disadvantages:

- impact on adjacent property (major land acquirements and limited entrances)
- entrance to side road from Parkdale N from the loop
- short weave section between Parkdale and Strathearne.

7.2.11 Scheme No. 10 – Cost = ±$18,850,000

Continuous Rigid Frame structure with 'B' type ramps.



Loop at Parkdale for left turns from Burlington Street to Parkdale southbound provides significant improvement to Parkdale-Windermere intersection which is the only difference to Scheme No. 6.

Advantages:

- easy access to industrial properties under the structure
- high capacity

flexibility of traffic movements. Eastbound traffic to Parkdale may be on the structure over Strathearne Ave.

- long weave section between Woodward Ave. and exit to Parkdale Ave.

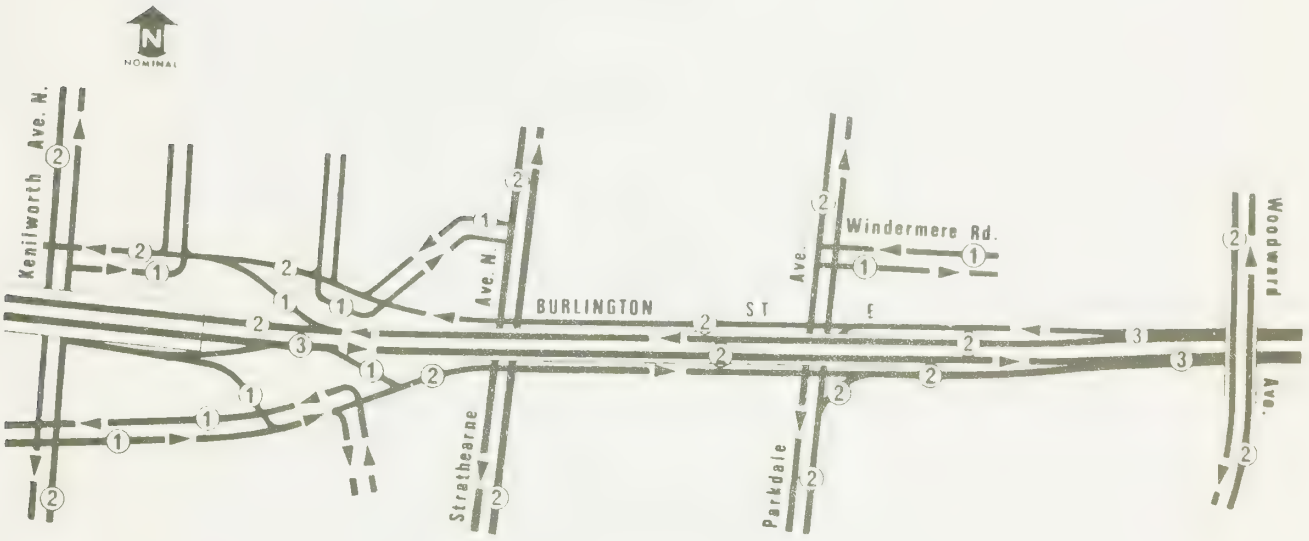
Disadvantages:

- high cost
- impact on Pioneer Service Station
- impact on Kent Steel Products.

7.3 RECOMMENDED SCHEME

7.3.1 Description

In the recommended scheme, the proposal is to provide a continuous structure from Parkdale to Strathearne Avenue for through traffic at Burlington Street, and at grade service roads for local movements.



The structure begins about 900' feet east of Parkdale Avenue and accommodates a 4-lane divided roadway, ending about 850 feet west of Strathearne Avenue. The minimum clearance provided is 15' - 3" with 20' - 0 for overheight loads at Parkdale and Strathearne Avenues. Burlington Street is widened to 6 lanes at the beginning of project and further widened to 8 lanes at the beginning of structure.

Two outside lanes on both sides form a service road system which provides connections to existing facilities and eventually is located under rigid frame bridge as 4 lane, 2 way service road. After intersecting Parkdale Ave. and Strathearne Avenue, the service road splits again into two roads and is connected to existing service roads on both sides of Burlington Street between Strathearne and Kenilworth Ave. Between the two structures, the proposed one and the existing structure over Kenilworth Avenue, there are transfer

lanes from the through lanes to the service roads both westbound and eastbound, and from the south service road to the through lanes easterly only.

7.3.1.1 Typical Cross-Section

The recommended cross section is a 4 lane divided arterial on elevated structure, and 4 lanes divided service road under the structure, as indicated on Exhibit No. 6 Minimum right-of-way width required for this section is 132 feet. On both approaches to the structure through lanes will be placed on fill with retaining walls, with service roads located outside the walls, as indicated on Exhibit No. 7. Both the through traffic lanes and service roads will be curbed, with paved shoulders and paved median. Sidewalks will be placed 2' inside the R.O.W. where required. The width of the median varies, with a minimum width of 6' provided at the connection to existing roadways. On the structure a 12 foot median is proposed with a New Jersey type median barrier on the centreline. Widening of service roads will be provided where required for bus-bays.

7.3.1.2 Horizontal Alignment

The centreline of the structure follows in general the existing centreline of Burlington Street with a significant southerly shift at the Parkdale Avenue intersection. The alignment is mostly tangent, with flat curves at the connection to existing facilities.

Alignment of the service roads is parallel to the alignment of the main lanes, with varying distance between westbound and eastbound lanes, depending on available clearances under the structure.

7.3.1.3 Vertical Alignment

The profile of the proposed service roads follows generally the alignment of existing Burlington Street, which is rather flat but rising to the west. To extend the weaving section on the westbound lanes and improve visibility, it is proposed to raise the existing south service road east of Kenilworth Avenue. On the structure approaches, a maximum grade of 5% is proposed with 500' visibility curves for crests, and 400' visibility curves for sags. The height of the structure is dictated by overheight clearances required at Strathearne and Parkdale Avenue intersections.

7.3.1.4 Intersections

At Parkdale Avenue - Point diamond intersection, Exhibit No. 3, predicted traffic volumes (see exhibit no. 2) indicate the need for a signalized and channelized intersection, with separate left turn lanes provided for each leg on the intersection. For the heaviest movements between Parkdale Avenue South and Burlington Street East double turning lanes are provided. Minor realignment of Windermere Road is recommended to provide sufficient width for trucks turning from Burlington Street westbound to Windermere.

At Strathearne Avenue – Point diamond intersection Exhibit No. 4. Under the structure a signalized and channelized intersection with Strathearne Avenue and Burlington Street is located, again requiring separate left turn lanes for each leg of intersection. There is a proposed buttonhook connection to the two-way north service road along its existing alignment. There are connections to the through lanes on the structure.

7.3.1.5 Entrances – Median Openings

Woodward to Parkdale Avenue – no access to Burlington Street
Parkdale to Strathearne Avenue – proposed are three median openings:

— opposite entrance to Procter & Gamble and Design Lithographers
— opposite Pioneer Service Station
— opposite entrance to Fine Papers Ltd.

All other entrances are limited to right turn in right turn out only.

Strathearne to Kenilworth Avenue

The North Service Road in its middle part is a one way facility, and due to this Energy Products Ltd., Jarvis B. Webb and Stelco properties can be only entered from Strathearne Avenue. Exits are provided in both directions.

Entrance to Firestone is provided from both directions on the North Service Road, but connection to it from the through lanes is eliminated due to widening of the service road to a three lane facility. Exit from Tire Road is limited to westbound only. Westinghouse on the South Service Road can be entered only from the west, with a two way exit from the west parking lot and an eastbound exit only from the east parking lot.

7.3.1.6 Illumination

The proposed illumination for both the elevated and at-grade sections of the roadway is recommended to be a high pressure sodium system using poles with a 35 foot mounting height. Poles will be located on the structure edges for the entire length of the bridge. Where service roads are on both sides of structure the additional lighting pole lines will be located on outer edges of the service road.

The average maintained horizontal illuminance at all locations, including intersections and points of access and egress is recommended to be 1.5 foot candles with a suitable arrangement that will provide maximum uniformity not exceeding a 3:1 average to minimum ratio.

The type of lighting poles and luminaires must be reviewed with the City of Hamilton at the time of detailed design.

7.3.2 Structure Requirements

7.3.2.1 Type

The proposed bridge will consist of trapezoidal section steel girders of weathering type steel made composite with a reinforced concrete deck. It is considered that such a structure will blend in favourably with one now in operation at Kenilworth Avenue. In addition the following merits can be summarized:

i) greatly reduced structural depth, since box girders will be connected into the sides of the pier capping beams
ii) construction will not require scaffolding
iii) span lengths will be of the same order of magnitude, resulting in repetitive fabrication and erection procedures.
iv) minimum traffic disruption
v) painting will not be necessary when atmospheric corrosion resistant steel is used, and sustained maintenance will not be required.
vi) minimum required profile grades and fill heights
vii) the clean external appearance of this type of bridge will be aesthetically pleasing as evidenced by a number of existing structures in Hamilton.

In the course of weathering certain soluble compounds are formed on the steel surface and these tend to be washed away by rain or condensation. The runoff can stain exposed concrete surfaces. Since extended protection can be provided by using a clean sealant applied on the concrete, the suggestion of using steel columns is discouraged and not recommended for the following reasons:

- de-icing salt used on the road during the winter months will attack the lower portions of the steel columns, preventing the all important weathering process and corrosion will then proceed unchecked.
- the oxide film's patina will vary in colour.
- forces acting on the columns are primarily compressive and since steel is better suited in tension, it is technically and economically more correct to use concrete in columns.
- location and alignment of two large sewers underneath Burlington Street will cause problems in establishing foundations west of Strathearne and may dictate the use of single shafted piers with large "hammerhead" cantilevers in conventional reinforced concrete. Moreover, utilitizing two materials of steel and concrete in the substructure would in this case not satisfy criteria of aesthetics.

7.3.2.2 Method of Construction

The suggested form of construction is illustrated on the cross sections on Exhibit No. 6. The size of the foundation and the number of piles will, to a large extent be controlled by obstructions in the form of numerous utilities traversing the site. Relocating these will therefore require close coordination with the pile driving operations and the construction of the foundations. The pier columns will be built outside or in between existing roadway limits, such that traffic will not be interrupted.

Prefabricated steel capping beams will be placed on top of the columns. These beams will have provision made for the prefabricated box girders to be connected on either side of the capping beam.

The erection of capping beam and box girders can be performed during the night when traffic is at its lowest volume. All structural steel will be shop welded and transported as complete prefabricated units. Erection on site will consist of assembling the girders by means of bolted connections only.

Following the steel erection, the bridge deck can then be constructed in two stages, if preferred, to allow traffic on the bridge as soon as possible.

To construct the east and west approaches to the structure within the available width it will be necessary to construct short retaining walls. During this phase, traffic may have to be located to the extreme north or south side of the roadway to minimize construction difficulties.

7.3.2.3 Cost

The Cost of the bridge structure can be divided into two categories, namely:

(i) The substructure, including foundations, columns capping beams.

(ii) The remaining superstructure, such as box girders, deck and median.

The cost ratio of substructure to superstructure will be of the order of 40% to 60% approximately. The cost of the recommended structure type has been calculated at $45.00 per square foot, and includes:

- excavation and backfill
- reinforced concrete
- structural steel
- piles
- bearings, joints and handrail

7.3.3 Property Requirements

The following property is required to accommodate the recommended scheme:

i) at the intersection with Parkdale Avenue on the south side of Burlington Street due to widening for structure, and involves the complete buy out of the Country Style Donut building and the Fina Service Station;

ii) at the east corner of Brighton Avenue/Leaside Road intersection-for Leaside Road relocation;

iii) strip 40 - 70 feet wide from C.N.R. from Parkdale easterly

iv) at Canadian Petrofina for improvement of intersection with Windermere Road;

v) property has been acquired from Jervis-Webb for widening the North Service Road to three lanes;

vi) local widening at Parkdale Avenue and Strathearne Avenue will require wedges of property;

vii) narrow pieces of property will be required from Westinghouse to accommodate widening of the Service Roads, however, no buildings are affected

Property requirements have been graphically indicated on the plans appended to this report but cannot be finalized until accurate mapping is available during the design stage.

7.3.4 Drainage Details

A complete storm sewer system will be installed for drainage of both the Service Roads and structure.

Between the east limit of the project and Strathearne Avenue the existing system will be reconstructed, including the relocation of the existing combined sewer (18 to 30 inches diameter) from the north to the south of Burlington Street.

In its present location, this sewer would be in conflict with the proposed structure.

West of Strathearne Avenue the existing facilities will be utilized as much as possible.

7.3.5 Utility Relocations

To avoid major utilities relocations, which are located mainly along both property lines and in the centre of the right-of-way, a rigid frame structure is proposed, with foundations located approximately along the edge of the existing roadway, as illustrated in the typical section appended.

7.3.5.1 Water

There is a possibility of conflict of the structure foundation with the 36 inch watermain at both limits of the structure. Local relocation may be needed. An 8 inch distributor main along south property line will be relocated, the existing location is in conflict with future column line foundations

7.3.5.2 Sewers

As described in Drainage Details — 7.3.4

7.3.5.2 Hamilton Hydro

No disturbance to main distribution facilities is expected, however, laterals to individual buildings may require relocation.

7.3.5.4 Bell Telephone

Major relocation is again not expected, although some laterals may require relocations.

7.3.5.5 United Gas

In the vicinity of west retaining walls, on both high and low pressure lines, local

relocation will be required. Strengthening of the existing main under the new pavement areas may be required. The median location between Parkdale and Strathearne Avenue will subject the existing main to additional wheel loads. Due to its older and possibly deteriorated condition, the relocation of this section to the right-of-way edge may be required.

7.3.5.6 Trans-Northern and Canadian Petrofina Oil Pipelines
Will not require relocation, but additional protection' under pavement will be necessary.

7.3.5.7 Hydro-Electric Power Commission
No relocation of underground ducts is expected, but two towers east of Parkdale will have to be raised to provide clearance for the structure approaches.

7.3.6 Construction Staging

The recommended scheme lends itself to a construction staging sequence that provides for traffic at all times and yet allows separate contracts for major activities. A more detailed construction staging and contract breakdown sequence would be developed during design based on the following major stages:

Preliminary Activities

— Relocate utilities in advance of construction by various utility companies, i.e. Bell, H.E.P.C., gas, oil, etc. Traffic on existing roadways. Approximate duration: April 1979 to August 1980;

Stage I

— Traffic on existing roadways.
— Complete service roads on new alignments west of Strathearne Avenue and east of Parkdale Avenue. Local traffic movements as required to complete segments of intersection areas.
— Complete pavement construction in median between Strathearne Avenue and Parkdale Avenue. Relocate combined sewer during this stage.
— Approximate duration: June 1980 to October 1980.

Stage II

— Place 5 lanes of traffic on north side of Burlington Street and complete south side foundations and piers.
— Move traffic to south side of Burlington Street and complete north side foundations and piers.
— Place traffic on median area between Parkdale Avenue and Strathearne Avenue, and on service roads beyond.
— Start steel erection.
— Approximate duration: April 1980 to July 1981

Stage III

— Complete steel erection during night-time and off-peak hours, and start deck construction.
— Approximate duration: July 1981 to October 1982.

Stage IV

— After structure complete, place through traffic on structure and complete service roads underneath.
— During this stage, a minimum of 1 lane of traffic each way in the service roads must be maintained.

- Project completed.
- Approximate duration: July 1982 to August 1983.

7.3.7 Cost Estimate

		UNIT	PRICE	QUANTITY	COST
1.	Removals	L.S.			90,000
2.	Roadwork				
	excavation	C.Y	3.00	20,000	60,000
	pavement structure	S.Y	10.00	65,000	650,000
	asphalt on the bridge	T	16.50	2,730	45,000
3.	Structure	S.F	45.00	265,000	11,925,000
4.	Drainage	L.S			170,000
5.	Illumination	L.S			280,000
6.	Traffic signals	EA.	30,000	2	60,000
	Sub Total				13,280,000
7.	Minor items, including: curb, sidewalk, guiderail fence, signs, markings etc. 12.5%				1,660,000
	Sub Total				14,950,000
8.	Engineering - contingencies +15%				2,250,000
	Sub Total				17,200,000
9.	Utilities				
	relocation & protection	L.S.			300,000
	hydro line raising	L.S			250,000
10.	Properties				1,000,000
	TOTAL				18,750,000

7.3.8 Construction Schedule

7.3.8.1 Contract Breakdown & Schedules

The following major contract activities are required in sequence, as shown on the attached schedule.

Engineering & Property Acquisition

During years 1 and 2, 1978, 1979 and into 1980, detailed design will be completed, property negotiations made and properties secured.

Utility Relocations

Once detail design is sufficiently advanced to be able to finalized detailed locations, arrangements will be made with various utility companies to move their utilities in advance of construction activities. Example would be gas

relocation to the R.O.W. edge, raising of hydro towers, protection to oil lines where required, movement of Bell and Hydro facilities, etc. These relocations could be separate contracts or by the utility companies themselves.

Contract No. 1 Detours & Utility Relocation
This contract would construct the service roads west of Kenilworth Avenue and east of Parkdale Avenue, pave the median between Parkdale and Kenilworth Avenue, and relocate the Region's facilities as required (water and sewer).

Contract No. 2 Foundations & Piers
Once the detour arrangement is available, a start would be made on the foundations and piers along both sides of the existing roadway. These would be roadwork as required for detour staging included in this contract.

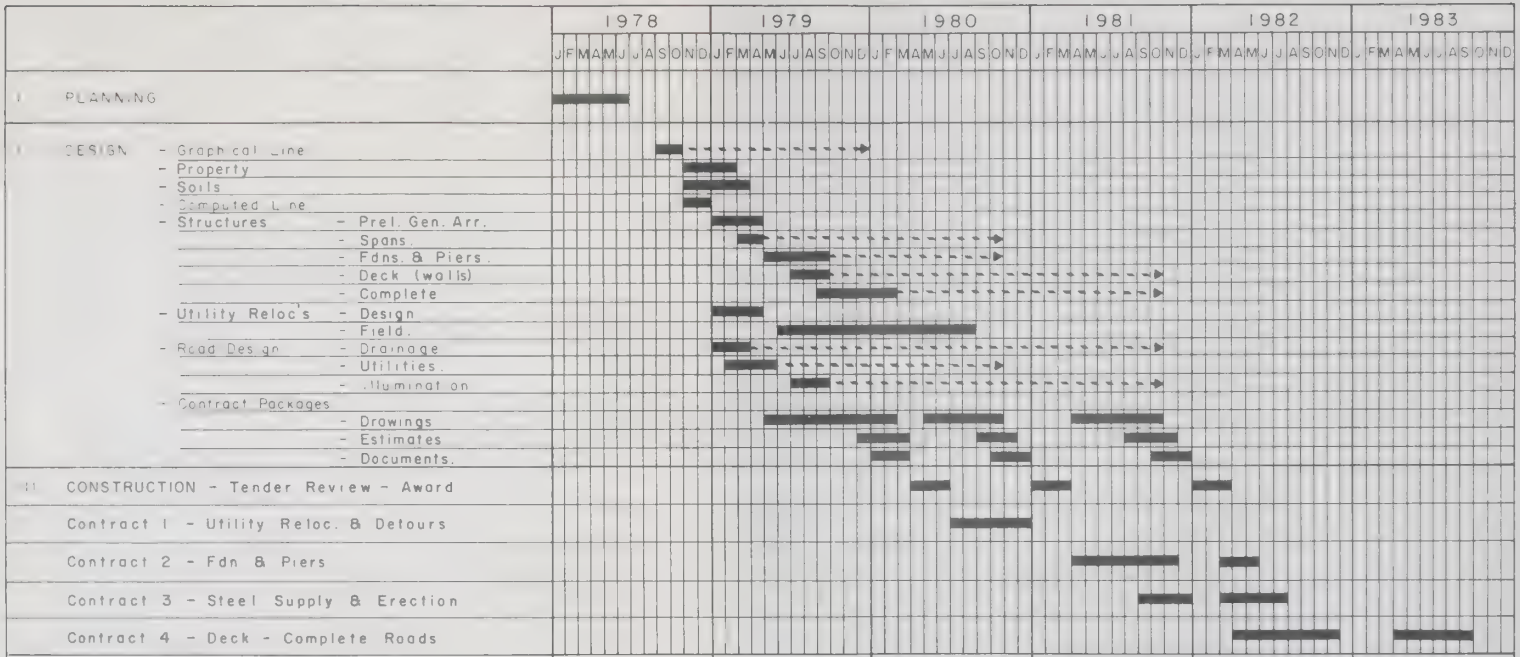
Contract No. 3 Steel Fabrication, Supply and Erection
A contract could be let concurrently with Contract No. 2 to fabricate and supply steel, and would serve to even out the annual cash flow. Structural steel would then be available as soon as piers are completed.

Contract No. 4 Place Deck, Complete Roads
The last contract would place the deck and complete roadworks underneath and adjacent to the structure, after it has been put into use.

NOTE: *For approximate timing of these events, refer to the progress schedule as attached.*

7 3.8.2 Annual Cash Flow
Based on the aforementioned schedule, annual cash flows would be approximately as follows:

YEAR	DESIGN & ENGINEERING	PROPERTY	UTILITY RELOCATION	CONSTRUCTION	TOTAL
1978	50,000	150,000			200,000
1979	500,000	850,000	200,000		1,550,000
1980	500,000		350,000	1,550,000	2,400,000
1981	500,000			5,000,000	5,500,000
1982	500,000			6,000,000	6,500,000
1983	200,000			2,400,000	2,600,000
TOTAL	2,250,000	1,000,000	550,000	14,950,000	18,750,000



IV COSTS PER YEAR

		1978	1979	1980	1981	1982	1983
DESIGN & ENGINEERING	2,250,000	50,000	500,000	500,000	500,000	500,000	200,000
PROPERTY	1,000,000	150,000	850,000				
UTILITY RELOCATION	550,000		200,000	350,000			
CONSTRUCTION	14,950,000			1,550,000	5,000,000	6,000,000	2,400,000
TOTAL	18,750,000	200,000	1,550,000	2,400,000	5,000 000	6,500,000	2,600,000

PROGRESS SCHEDULE

Figure 9

8.0 PUBLIC PARTICIPATION

8.1 PROPERTY OWNERS

Rather than a general 'open-meeting' type of public information program, meetings were held with each individual property owner along the route to explain the impact of various reconstruction alternatives to them. These meetings were held after the 2 preferred reconstruction alternatives were decided on by the Technical Advisory Committee, namely, a lower construction cost but maximum property scheme – Scheme No. 5, and the higher construction cost but minimal property impact scheme – Scheme 10.

As a result of the input available from the property meetings, the preferred scheme was refined into the final Recommended Scheme No. 11 as outlined in section 7.0.

The major influence of property problems and the resultant effects, are summarized below:

- severe impact from loss of parking, manoeuvring and expansion area at Kent Steel eliminated the ramp, resulting in the adoption of the point diamond intersection at Parkdale Avenue.
- loss of access to the Pioneer Service Station east of Strathearne Avenue would result in buy out and removal of the station, hence, the off ramp for eastbound traffic as shown on Scheme 10 was eliminated, and this exit movement placed between Kenilworth and Strathearne Avenues.
- property problems at MacLarens, and Westinghouse, at the Strathearne Avenue intersection made the point diamond intersection, with a button hook connection to the North Service Road the viable solution.
- substantial property damages to Safety Supply, Acklands, Barber-Ellis, Design Lithographers and Pioneer Station made Scheme 5 approximately equal in overall costs of Scheme 10.

The Regional Engineering Department, under separate cover, will be supplied with a document containing results of all property meetings.

8.2 UTILITY COMPANIES

A single meeting was held with all the utility companies affected by the proposed reconstruction. These included:

- Trans-Northern Pipelines
- Petrofina Canada Limited
- Union Gas
- H.E.P.C.
- Hamilton Hydro
- Bell Telephone
- Regional Municipality of Hamilton-Wentworth

Details of construction were outlined and the probable effect on installed utilities discussed. It was agreed that major utility relocation work would not be required, however, the following concerns are noted:

i) Trans-Northern Pipeline and Petrofina Canada
   - local protection required during construction
   - possibly some additional pipe protection under new roadway areas.

ii) Union Gas
- older gas main under median, may have deteriorated.
- additional wheel loading may necessitate relocation to R.O.W.
- laterals to buildings may require relocation.
- west of Strathearne Avenue relocation required.

iii) H.E.P.C.
- tower raisings required east of Parkdale Avenue.
- substantial lead time (2 years) required for ordering of materials.

iv) Hamilton Hydro
- protection during construction required
- power interruptions not possible
- require lighting ducts in structure

v) Bell Canada
- protection during construction
- lateral relocations needed

vi) Regional Municipality
- combined sewer will require relocation, Region may provide for separation of sewers into sanitary and storm systems
- deep sewers may conflict with piling for foundations
- existing watermain under eastbound lanes may be affected.

During design it will be necessary to accurately locate all facilities and plot on the latest mapping used for developing general arrangements. Co-ordination with utility companies during design and preliminary construction activity will be a significant requirement to ensure continuity of essential services to the industrial companies.

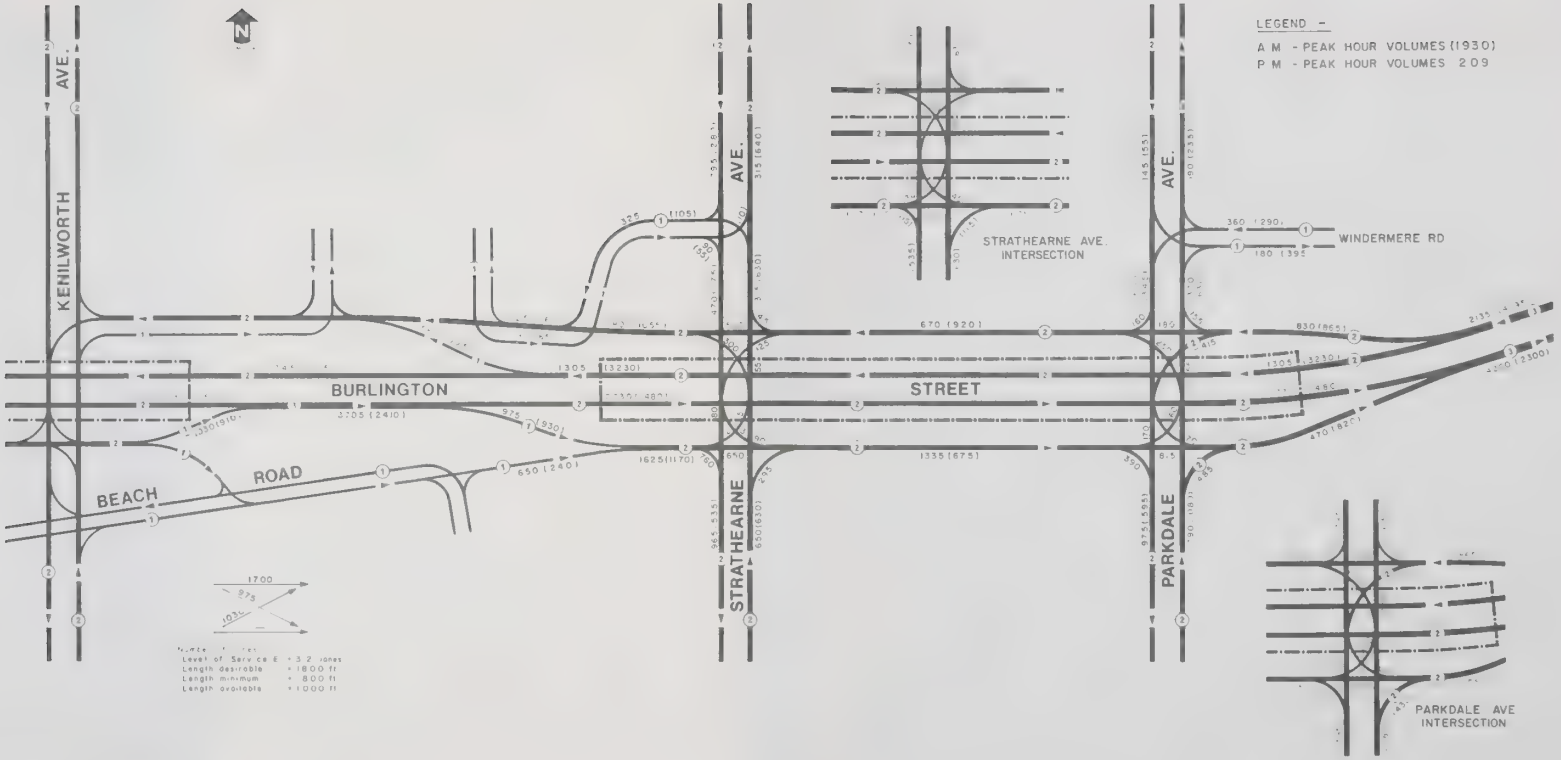
The Regional Engineering Department will be supplied with copies of pertinent correspondence regarding utilities.

appendix

plan
profiles
cross-sections

burlington street reconstruction

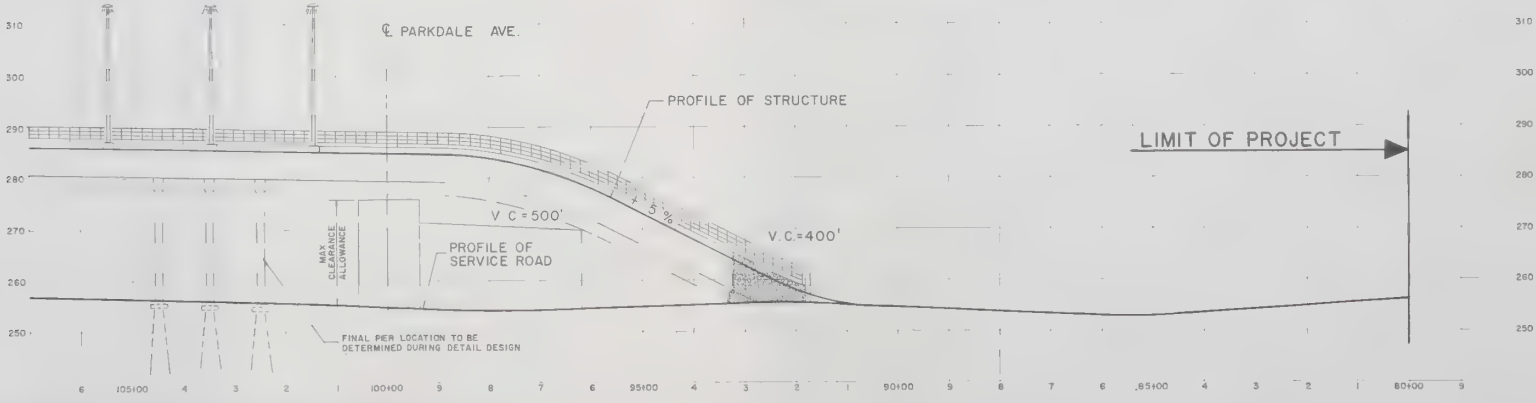
FENCO



BURLINGTON STREET RECONSTRUCTION

LINE DIAGRAM
RECOMMENDED SCHEME

2

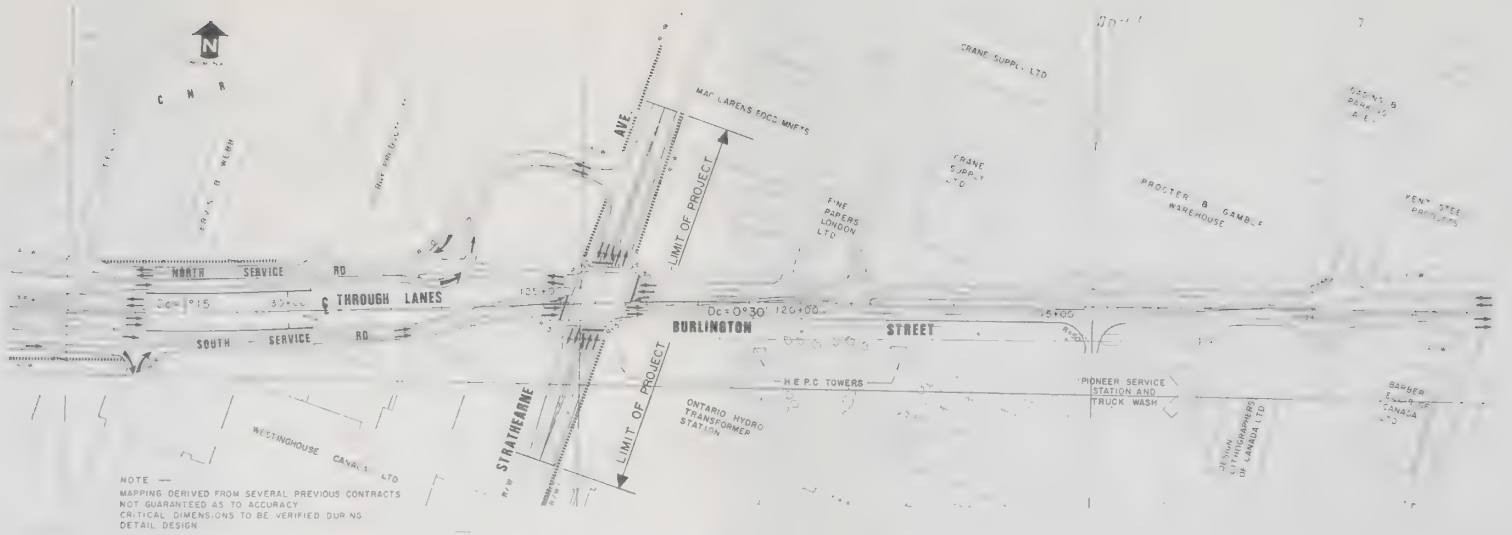


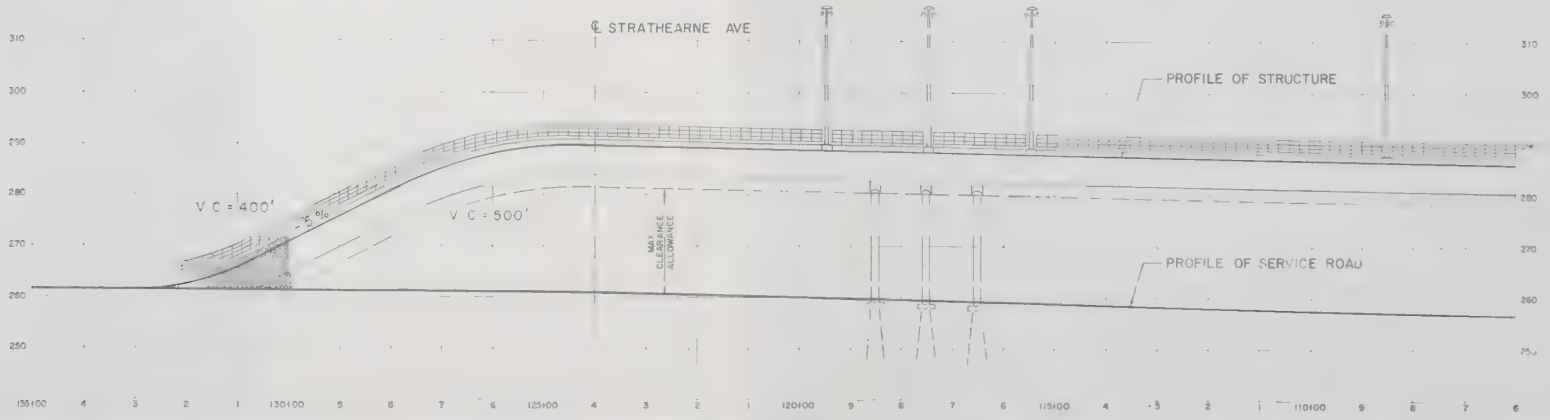
BURLINGTON STREET RECONSTRUCTION

PLAN AND PROFILE

PARKDALE TO STRATHEARNE

3



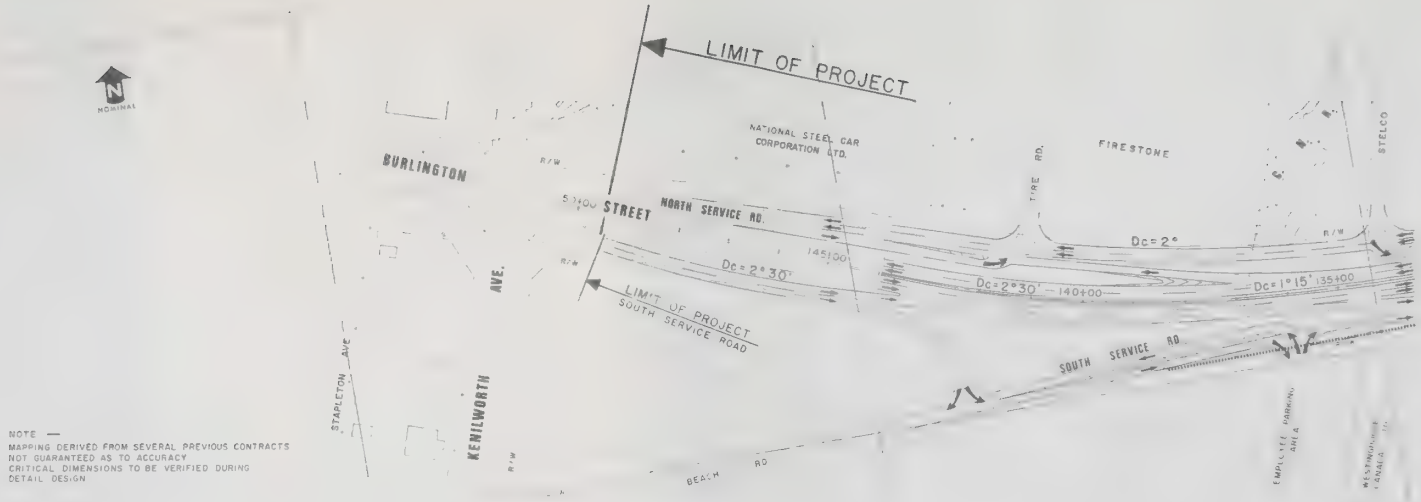


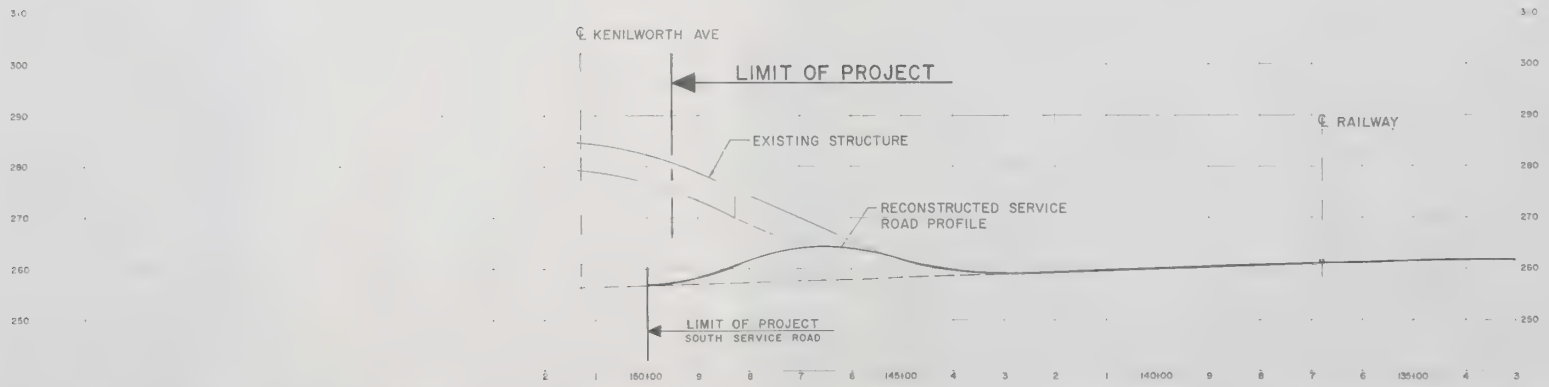
BURLINGTON STREET RECONSTRUCTION

PLAN AND PROFILE

STRATHEARNE AVE. INTERSECTION

4



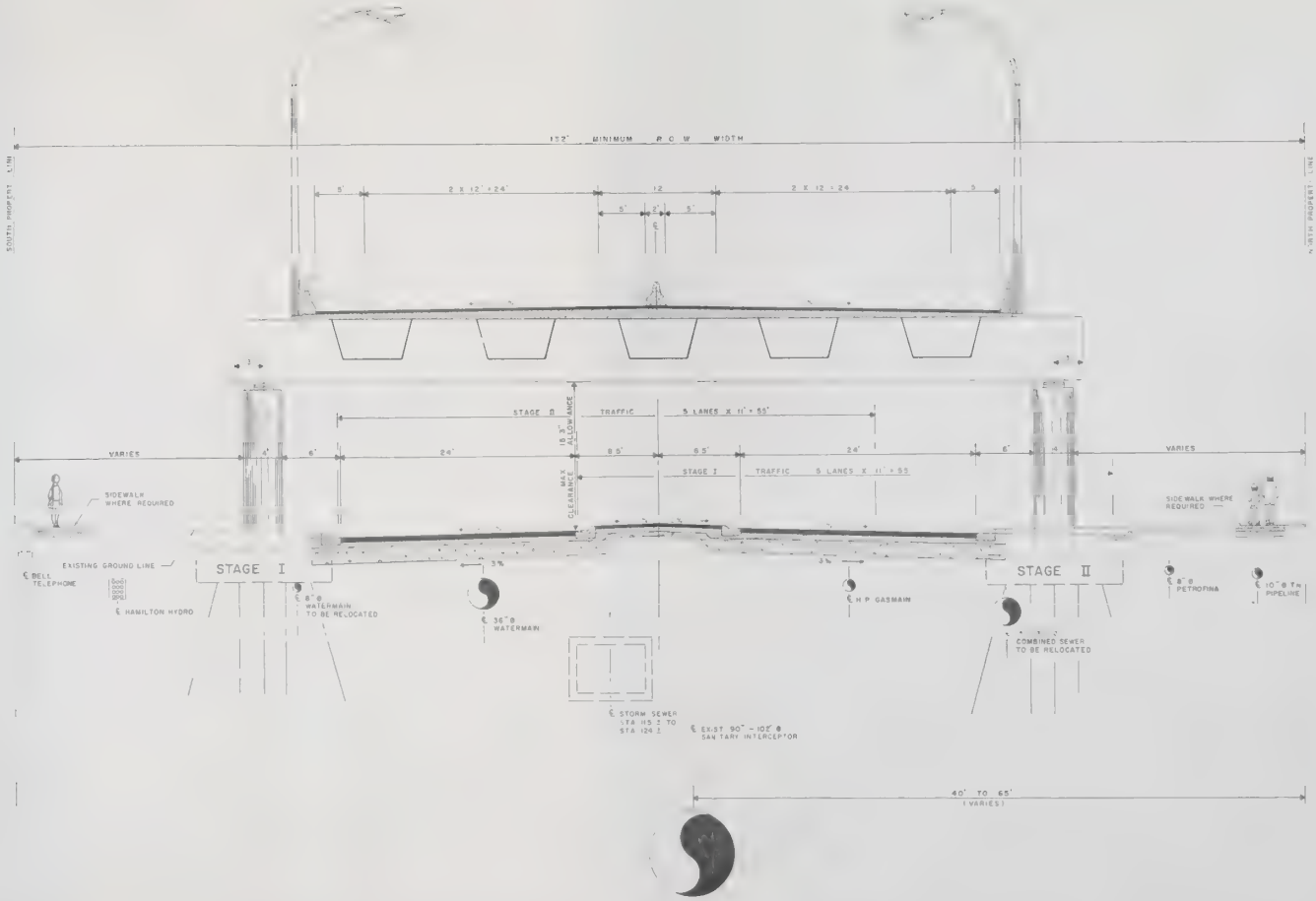


BURLINGTON STREET RECONSTRUCTION

PLAN AND PROFILE

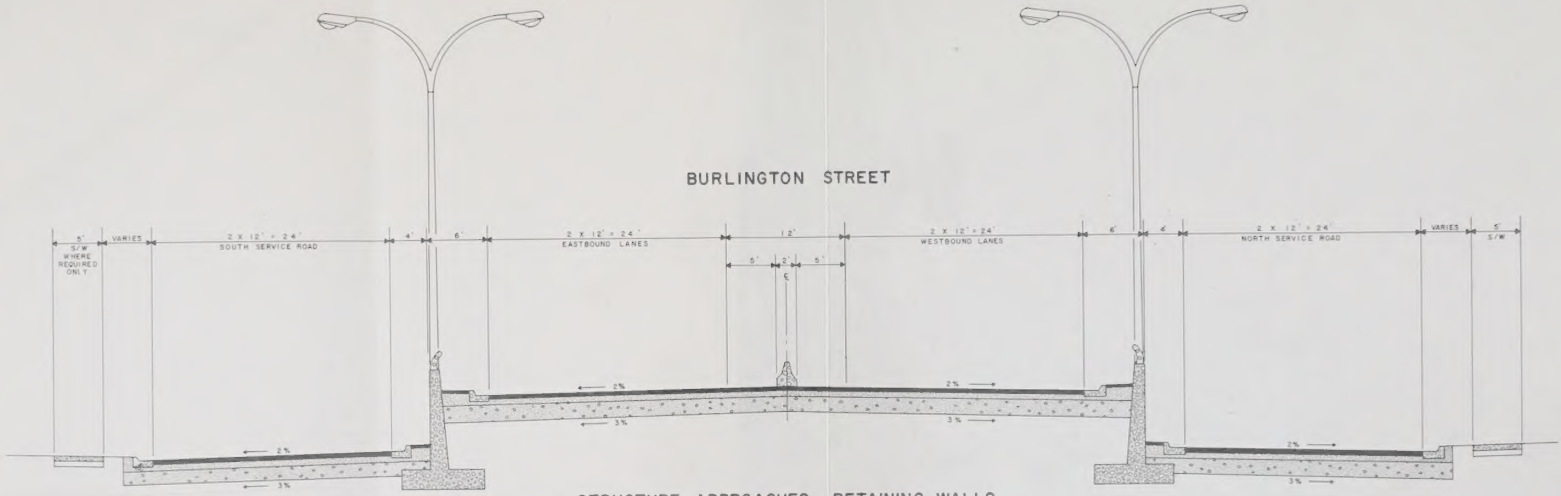
STRATHEARNE TO KENILWORTH

5

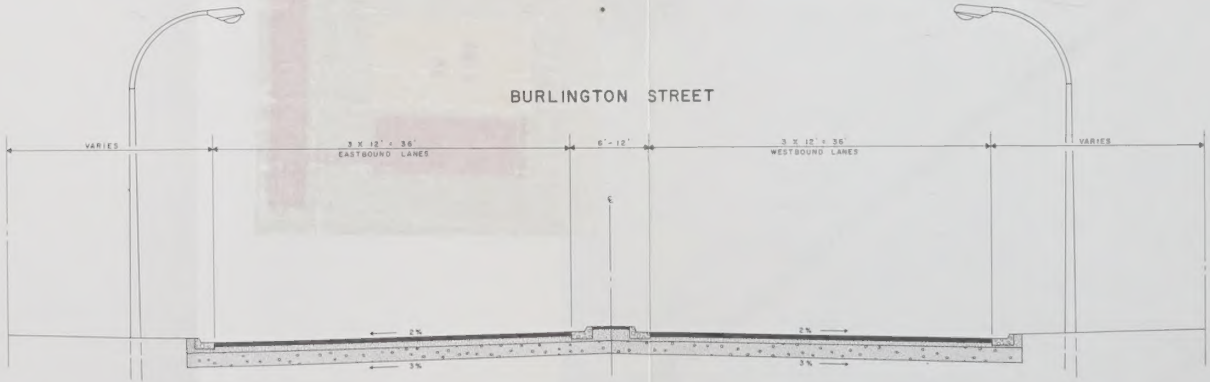


BURLINGTON STREET RECONSTRUCTION

TYPICAL SECTION
• Structure •



STRUCTURE APPROACHES - RETAINING WALLS



AT GRADE APPROACHES

BURLINGTON STREET RECONSTRUCTION

TYPICAL SECTION
• Approaches •

7

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